The

Electrical Review

VOL. C. JUNE 24, 1927. No. 2,587.

THE OLDEST ELECTRICAL PAPER. ESTABLISHED 1872.

Published every FRIDAY, Price 6d.

Chairman: H. ALABASTER

Technical Editor: A. H. ALLEN, M.I.E.E. *Joint Managing Directors:* G. H. ALABASTER. E. A. GATEHOUSE M.I.E.E., A.M.INST.C.E. *Commercial Editor:* A. H. BRIDGE.

Manager and Secretary: E. S. MIDDLETON.

OFFICE: 4, LUDGATE HILL, LONDON, E.C.4.

Telegraphic Address: "AGEEKAY, CENT., LONDON." Code, A B C. Telephone No.: Central 7872 (Three Lines).

The "Electrical Review" is the recognised medium of the Electrical Trades, and has by far the Largest Circulation of any Electrical Industrial Paper in Great Britain.

SUBSCRIPTION RATES, Postage Free: United Kingdom, £1 14s. 8d.; Canada, £1 12s. 6d. Colonial and Foreign, £2 1s. 6d. per annum. Cheques and Postal Orders (on Chief Office, London) to be made payable to THE ELECTRICAL REVIEW, LIMITED, and crossed "Midland Bank, Newgate Street Branch."

For List of Foreign Agents for the ELECTRICAL REVIEW see Advertisement Supplement.

Contents:

	PAGE
Our Hundredth Volume	1001
The I.E.E. Wiring Rules	1002
Engineering Finance, Economics and Organisation	1002
The Contractors' Convention	1002
The Growth of the B.I.F.	1003
Preserving the Amenities	1003
Our Service Department	1003
The Institution of Electrical Engineers (*illus.*)	1004
Swiss Railway Electrification, by H. W. Schuler (*illus.*)	1007
Ironclad Switching Systems	1009
Japan and the Electrical Industry, by A. Riddle	1010
Wireless Batteries, by Paul D. Tyers	1012
Business and Industrial Notes	1014
Lighting and Power Notes	1018
Tramway and Railway Notes	1020
Telegraph and Telephone Notes	1021
Radio Notes	1021
Contract Information	1021
Forthcoming Events	1023
Notes	1023
Institution Notes	1025
Our Personal Column	1025
Financial Section—	
New Companies Registered	1026
Official Returns of Electrical Companies	1026
Financial Section—*continued.*	
City Notes	1027
Stocks and Shares	1029
Our Foreign Electrical Trade	1031
South African Electrical Trade	1032
Radio Battery Eliminators, by P. R. Coursey and H. Andrewes (*illus.*)	1033
Mixed Pressure Colliery Turbines	1035
Electrical Measurement of Temperature, by J. Hall	1036
A New Direct-Current Meter (*illus.*)	1037
Electricity Supply in the West Midlands, by S. T. Allen	1038
Electromagnetic Couplings (*illus.*)	1039
New Electrical Devices, Fittings and Plant (*illus.*)	1040
Parliamentary News	1041
Correspondence—	
E.h.p. Transmission with 33,000-Volt Cable	1041
Cheaper Wiring	1041
Metal-clad Draw-out Switchgear	1041
Legal	1042
Reviews	1042
Published Specifications	1043
Trade-mark Applications	1043
New Work for Contractors	1044

Our Hundredth Volume.

WITH this issue the hundredth volume of the ELECTRICAL REVIEW is completed; it is an event of some significance, bearing silent testimony to the age of an industry which, however, as industries go, is still in its youth, with the prospect before it of unbounded prosperity when it is in its prime. Nearly five years ago we celebrated the fiftieth anniversary of the birth of this journal; the reason why the two dates do not coincide is that during its early years only one volume was completed each twelvemonth.

Starting on November 15th, 1872, as "The Telegraphic Journal," on January 15th, 1873, it added the sub-title "and Electrical Review." Turning over the old volumes, it is interesting to observe that the former title gradually shrank whilst the latter was printed in larger and larger type, until in 1882, when for the tenth volume the present format was adopted, the telegraphic title became subsidiary, and in 1892 it disappeared completely. That gradual change was symbolic of the great transformation that was taking place in electrical engineering—the growth of a new and vastly greater branch from the parent stem, the extension of the electrical field into all departments of civilised existence.

Yet our first issue was not wholly devoted to telegraphic subjects; pure science was also represented, a new thermo-pile was described having "an intensity equal to that of 60 Daniell elements," and an automatic arc lamp was illustrated. "City Notes," then as now, dealt with finance and industry, noting the opening for traffic on October 21st of the British Australian Company's cable which afforded direct communication between London and Melbourne. This year, in our hundredth volume, we have recorded the opening of a channel of communication between those cities without the use of a cable—the beam wireless system, which is a no less meritorious achievement than the former.

An outline of the history of the ELECTRICAL REVIEW was given in the Jubilee number of November 17th, 1922, but the keynote of that issue was "Looking For-

ward." Continuing in that vein, it would be interesting to speculate upon the appearance and contents of the 200th volume; when that appears, we fancy, the all-electric age will have arrived. Dr. Ferranti's dream of electricity at ½d. per unit will have been realised, our railways—if transport still goes by land—will be electric, and the "grid" will not only have been completed but superseded by directional radiation of electric power.

The I.E.E. Wiring Rules.

THE new (ninth) edition of the I.E.E. Regulations, just issued, takes the place of the edition which was published in 1924 and subsequently amended by leaflets. It is stated that it contains some alterations which had become urgent, but as no one can cheerfully face the task of comparing the two volumes line by line, we venture to express regret that no indication of the places where changes have been made appears in the text. Had this been provided, men who were familiar with the text of the Eighth Edition (if they existed, outside the ranks of the Wiring Regulations Committee) could easily have brought their information up to date.

The fact that a Tenth Edition was on the stocks has been more or less widely known; it is now officially announced, together with the glad news that it will take a simpler form than that which is now current. To expect a wireman to be *au fait* with a book containing 128 Regulations and 14 tables is to ask too much of any man; it defeats its own object. The Home Office plan of issuing a comparatively short set of Regulations and supplementing it with an explanatory memorandum is much better. In the I.E.E. code the attempt has been made to deal with every case that is met with in electrical installation work, instead of stating broad principles, laying down a few definite and essential requirements, and relegating long-winded definitions, explanations, and alternatives to an appendix or a separate memorandum.

Anyone who turns over the pages of the book must recognise at once its resemblance in some respects to an engineering specification, although its use as such is expressly deprecated, or to a text-book, which again is declared to be no part of its purpose; moreover, it possesses some of the characteristics of an Act of Parliament. There is far too much verbiage, and too little is left to common sense. It may be argued that common sense is scarce; our reply is that a man without common sense will take little heed of rules, long or short. We should like to know how many installations carried out since 1924 comply strictly with the regulations. Does any?

Engineering Finance, Economics and Organisation.

THE speeches delivered last week at the luncheon of the British Engineers' Association were commendably brief and businesslike. Mr. H. J. Ward, the president, with a few appropriate sentences, introduced the principal speakers—Mr. Reginald McKenna, the head of our largest Bank, and Sir Arthur Balfour, chairman of the Committee on Industry and Trade. Each of these gentlemen knew exactly what he was going to say and how to say it.

The Association passed a resolution early in the year asking that an inquiry should be held into the theoretic basis and practical technique of our credit and currency system, including the Bank of England as the central institution and custodian of our monetary resources. Mr. McKenna felt that the resolution was a wise one and should have been acted upon by the Government without delay, but the Chancellor of the Exchequer thought differently, or to be precise, he was not aware of any sufficient grounds to justify such an inquiry, which, he said, would have an unsettling effect in many directions. Mr. McKenna's speech was a reply to the Chancellor. He showed what had been happening along the same lines in many other countries which were not afraid of an "unsettling effect," and added that it would not be very difficult to give sufficient reasons why we should hold such an inquiry. None of the countries which had reformed their financial institutions had copied the Bank of England, but they had adopted some system similar to the Federal Reserve Act of the United States. This surely suggested that there was something for us to inquire into. We had no generally accepted body of opinion in this country; an inquiry would help us to form such, and on the basis of a well-informed public opinion we could establish the finest system in the world.

The speech of Sir Arthur Balfour, who stands high in the industrial world, as Mr. McKenna does in that of finance, was devoted to the International Economic Conference at Geneva from which he had just returned. He paid a tribute to Mr. Bremner, the Director of the British Engineers' Association, for the service he had rendered by preparing for the Conference the "finest document on engineering ever produced in this country," a document which was the admiration of the representatives of all the fifty nations represented at Geneva. Among the conclusions reached at Geneva was one that cartels and industrial agreements could only be applied to relatively few industries, namely, those where the article produced was similar and comparable in different countries. It was proved to be a fallacy that tariffs could be reduced by means of cartels; sometimes the reverse occurred. The Conference held that tariffs were too high, too complicated, and too often changed. It was obvious that new productive plant was being put up, though the world already had more than was needed. Subsidies were a curse; the more trade and commerce were left to people who understood them and were left alone by Governments and politicians, the more business we were likely to do. Sir Arthur asked what steps were to be taken to bring the recommendations of the Conference home to the people. Such bodies as that Association should play a part in such a direction. All trades in this country should be organised as they were. In future we should have to spend a great deal more money upon our trade organisations if we wished to compete with foreign countries. More brains from the industries themselves—especially from the younger men—must be brought to bear upon Trade Association matters; such organisations should not be run by "officials." Some kind of International Association was needed and younger men should acquaint themselves with the subject of international negotiations. Sir Arthur made the familiar but still painfully true remark, that hard work and better organisation were what were needed to bring the world right—fancy schemes must be abandoned. If we wished to defeat Sovietism we must organise as quickly as possible to develop the stream of better trade which was indicated by last year's return—and give employment to our people; we must work together better, each striving in his own works to reduce grievances—the food upon which Sovietism throve.

Mr. Bremner, the closing speaker, referred to the difficulties of the engineering industry, adding that the work contributed by individual firms in support of his Association was so small as to be a grave reflection. It was deplorable that they should find it necessary to augment their subscription income by means of revenue derived from extraneous sources such as an engineering directory and British Empire Exhibition profits. He appealed to the industry to find the money and the other necessary support for maintaining efficient trade organisations.

The Contractors' Convention.

THE Electrical Contractors' Association is making excellent progress. Its membership has passed the thousand mark, and in many directions members are feeling the benefits of the Association's added strength. The papers presented at the second annual Convention of the E.C.A. Allied Associations at Scarborough this week were of a high order and were full of interest not only to the contractors to whom

they were addressed, but to supply authorities and other members of the electrical industry.

Next week we shall deal with some of these papers, but here we may say briefly what each was about. Mr. Grierson, in "Some Interesting Points in Connection with Modern Installation Work," stressed the need of the contractor for less stringent conditions; the present ones, if those quoted are indeed fair samples, certainly bear hardly upon members of the trade. Care was counselled in fixing costs of quantities and time of an indefinite nature. Mr. Grierson's text was "Union is Strength," and he said that a "hundred per cent." membership of the E.C.A. would lead to a vast improvement in the conditions under which electrical installation work is carried out.

Mr. J. Kirkham's paper aims at showing how narrow a margin separates success from failure in the electrical contracting industry, and stresses the need for proper costing—as distinct from mere accounting. Methods of dealing with the many items not relating to particular jobs are outlined, and not only contractors will find the paper worthy of study. In his concluding address the new president, Mr. W. A. Shaw, expresses the necessity for more contractors' showrooms, and Mr. H. F. Walker deals with this matter in his paper to-day on "The Electrical Showroom as a Commercial Proposition and its Relation to the Industry." It must be said, however, that the author places first in his list of factors essential to progress the reduction of the cost of electricity to an absolute minimum. The electrical education of the public comes second, and harmony within the industry third. He agrees with the maintenance of permanent displays by municipal supply authorities, but says that these should not be employed for the discouragement of private enterprise: their object should be purely educational—for the sale of more energy. Mr. Walker submits that the contractors are the people to set up the showrooms which will be necessitated by the development of the industry, and deals in detail with the organisation and arrangement of such showrooms.

The Growth of the B.I.F.

WHEN discussing the future of the British Industries Fair in our issue of April 1st (p. 502) we advocated as one way of overcoming the difficulty of expansion at the London end the transfer of certain classes of exhibits, including those of electrical and allied classes, to Birmingham, where there is abundant site space available. We are not familiar yet with the nature of the new arrangements, but it would seem that the difficulty referred to has been negotiated satisfactorily, from the official standpoint at all events, for we learn that for the Fair which is to be held from February 20th to March 2nd, 1928, the exhibition area in London will exceed the space provided there last time by 100,000 square feet. At Castle Bromwich, Birmingham, extensions of 80,000 square feet are to be made. We are informed that the space already applied for in the Birmingham section amounts to double that taken by the corresponding time last year. We are glad to note this, but not in the least surprised, for the enterprise shown by the Birmingham Chamber of Commerce has been one of the outstanding features of the development of the Fair during the last few years. It is certain that unless the Chamber, through its electrical members, had taken up our particular branch of the trade two years ago, there would have been little left by way of electrical exhibits. The assistance that it has been our privilege to render in connection with its progress has been given because of our firm conviction that the electrical and allied trades should fill an increasingly important place in the Fair. An exhibition held under Government auspices to impress buyers with the character, variety and extent of British products must, of course, contain a strong representation of British electrical manufactures. Yet we do well to remember that, however important we may regard it, the electrical is but one out of a host of sections, and innumerable considerations have to be borne in mind in settling matters of general policy.

Any doubt that has been expressed regarding a possible abandonment of the Fair, under the Government economy plans affecting the Department of Overseas Trade, is set at rest by the official intimation that the Government has leased the White City for the London Section for the necessary periods in 1928, 1929, and 1930. Application forms have been sent out to approximately 10,000 British manufacturers regarding this Section, and no doubt the Birmingham authorities will soon be proceeding energetically with their electrical and other activities. Their space application forms have already been circulated. What they asked last February was that different branches of industry should guarantee certain support for a period of years. With three Fairs assured, perhaps this may be a reasonable basis upon which electrical exhibitors can discuss various matters, including maybe the question of date which some seem to think should be reconsidered.

Preserving the Amenities.

WRITING to the *Morning Post*, the Countess Bathurst expresses apprehension lest one effect of the national scheme of electricity supply be to string unsightly overhead mains on hideous steel masts across Britain's beauty spots, as, she says, has happened in Switzerland and Italy. Prof. J. A. Fleming, in reply, points out that the alternative of underground cables which the Countess advocates is not practicable at 135,000 volts, but he puts forward the interesting suggestion that all lattice towers, outdoor switchgear, and transformer stations should be painted green or brown, or whatever colour best matches the prevailing tint of the landscape. In Switzerland, he says, this practice is being adopted, and certainly it appears to be commendable, even though it affords only a partial remedy for the complaint. Dr. Fleming adds that in England little or no attention is being paid to this question; lovely districts have been recklessly disfigured in Wales, but in Switzerland care is taken to place power stations and lines as far as possible from such places.

Now is the time—before the "grid" has begun to take shape—to impress this important consideration on the minds of the responsible authorities. The national interconnecting mains must inevitably be overhead, but something can be done to mitigate their ugliness; how obtrusive overhead construction can be the Post Office has shown us with its lines of 50 or 100 conductors running across the country.

Our Service Department.

JUDGING by the diffidence with which inquiries are sometimes addressed to us, it would appear that some of our readers are not yet aware of the existence or, at any rate, of the functions of our Service Department. That branch of our activities, as its name implies, was developed for the express purpose of affording information on any subject within our province to any reader who is in need of it; we receive some thousands of inquiries every year, and are happy to be able to satisfy by far the most of them. All answers are sent by letter, as soon as possible, provided that a stamped addressed envelope is enclosed with the inquiry. Occasionally we have to appeal to readers for the solution to a poser, and we are grateful to the many correspondents who have responded to our invitation. We hardly need say that requests for detailed specifications, data for winding magnets and armatures, and similar matters which fall more appropriately within the scope of a consulting engineer's practice are not suitable for treatment by our Service Department, though many inquiries of this class are received; its aim is rather to serve as an encyclopædia of facts and data which are already in existence but which the reader is unable to set hand on—an electrical reference bureau, so to speak—and thus to serve the needs of the industry. We much prefer to receive inquiries by letter rather than by telephone, for many reasons.

The Institution of Electrical Engineers.

Summer Meeting at the North-Eastern Centre.

(*Continued from page* 970.)

ON the Wednesday morning the North Tees generating plant of the Newcastle-upon-Tyne Electric Supply Co., Ltd., and associated companies* was inspected, luncheon being provided at the power station by the Company, which is the largest concern of its kind in this country. Its area of supply covers 1,600 sq. miles, populated by some two million people, and the number of generating stations running in parallel with the system is 34, their yearly output being approximately 1,000,000,000 kWh; the number of stations owned or operated by the Company is 20, their yearly output being approximately 900,000,000 kWh (200,000,000 of these units are generated by means of waste heat). The demand on the Company's system is 175,000 kW; the route length of cables laid and overhead lines erected is 1,550 miles; the route length of 66,000-volt cables and lines is 60 miles, and the route length of 20,000-volt cables and lines is 400 miles. The number of sub-stations is 626, whilst the horse-power connected to the system is 665,000, and the annual average rate of h.p. connected during the last ten years has been 30,600 h.p. The number of consumers supplied directly and in bulk from the system exceeds 100,000, those connected directly to the Company's system exceeding 60,000 (more than 16,000 new domestic consumers were connected during the year 1926). The number of collieries supplied is 180. The capital expenditure has been £11,700,000. Situated at Haverton Hill, in the County of Durham, on the north bank of the River Tees, opposite to the town of Middlesbrough, the site covers 56 acres, with a river frontage of nearly half a mile; "A" station was put into commission in 1920, and the first part of the "B" station in 1923. The former contains two 20,000-kW Metropolitan-Vickers machines, each consisting of a high- and low-pressure turbine, and two 10,000-kW 11,000-volt alternators, in tandem, running at 2,400 r.p.m. The turbines are of the single-flow type, in opposition, and the last stages of the low-pressure turbines are of the multiple exhaust design. The two generators are normally operated as one unit, but are coupled together through switchgear so that either can be used separately. The ten boilers, by Babcock & Wilcox, Ltd., each have a capacity of 42,000 lb. per hour. The steam pressure is 475 lb. per sq. in., and the temperature is 700 deg. F.; five boilers are fitted with reheaters, which raise the temperature of the steam to 520 deg. F. in its passage from the high- to the low-pressure turbines of each machine. There

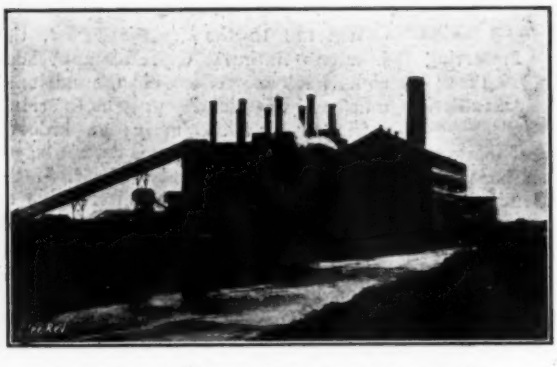


Fig. 3.—The North Tees "A" and "B" Power Stations.

are no economisers; in their place air heaters have been installed by means of which the hot gases passing from the boilers are used to raise the temperature of the air supplied to the grates to about 400 deg. F. All the boilers discharge into one brick chimney with common fan equipment. Provision is made for oil firing five boilers. The feed water is heated, first, by steam drawn at two stages from the low-pressure turbines, and then by steam taken from the high-pressure exhaust, its final temperature being 300 deg. F. The pumps are electrically driven, with steam-driven pumps in reserve, and the air from the alternators passes to the boiler air ducts. The ash conveyors are of the suction type.

The "B" station contains one 20,000-kW "Metrovick" generator similar to those in the "A" station, and two 25,000-kW 11,000-volt Parsons sets, which consist of high- and low-pressure reaction turbines and a single alternator; the low-pressure cylinder is of the double-flow pattern with twin condensers. The speed is 2,400 r.p.m., and in the case of these machines, the steam entering the low-pressure turbines is not reheated.

Steam can be interchanged between the "A" and "B" stations; in the latter, eight boilers manufactured by Babcock & Wilcox, Ltd., each have a normal capacity of 75,000 lb. per hour, 475 lb. per sq. in., and a temperature of 750 deg. F. As in the case of the "A" station, air heaters are used instead of economisers, and the feed water is heated by steam extracted from the turbines, but its layout differs from that of the "A" boiler house in that each boiler has its own chimney and a separate equipment for the induced and forced draught (fig. 3). The alternators are provided with a closed air circuit, the air being cooled by the condenser circulating water. The ash conveyors are of the water trough scraper type supplied by the Underfeed Stoker Co., Ltd.

Fig. 4.—Bishop Welldon and Guests at Durham.

The condenser circulating water pump house, which is common to both stations, contains four vertical centrifugal pumps manufactured by Gwynnes Engineer-

* See ELEC. REV., July 4th, 1924.

ing Co., Ltd., each being capable of delivering 1,560,000 gallons per hour. The main switchgear was manufactured by Messrs. A. Reyrolle & Co., Ltd. The generators feed straight into the mains; there are, however, two sub-stations on the site, in one of which the pressure is raised to 20,000 volts for supplying distant consumers, and in the other to 66,000 volts for linking-up the Company's stations on the River Tyne. The 44,000 kVA of step-up transformer plant now available is to be increased to 68,000 kVA in the near future. The network in Middlesbrough and other districts south of the river Tees is connected to the station by twenty cables laid in a trench dredged in the river bed at a depth of 30 ft. below low water. The control room is equipped with a large diagram showing the southern portion of the high-pressure system, which enables the engineer-in-charge to have full control of the distribution of load in this area. Employés are provided with houses on an estate laid out by the Company on garden city lines in the village of Billingham, about a mile from the power station. There are seventy-three houses, all of which are equipped for electric heating and cooking.

Fig. 5.—At the Hebburn Switchgear Works.

Fig. 7.—Assembling for the Official Photograph.

On the Wednesday afternoon the main party proceeded to Durham to visit the cathedral, the old monastry with its 14th century kitchen, library which contains the Cuthbert relics and Lindisfarne Gospels, and numerous other features of interest. Tea was served on the Deanery lawn by the kindness of Bishop Welldon, D.D.

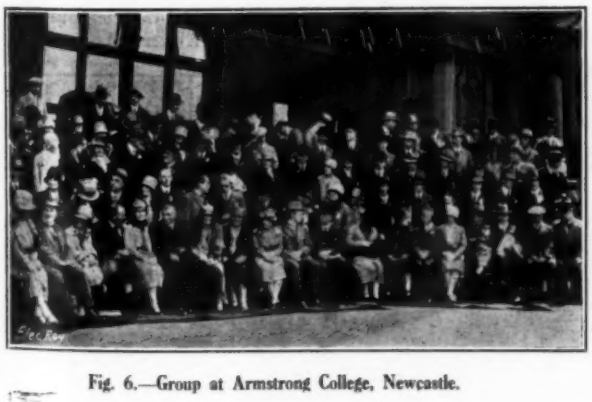


Fig. 6.—Group at Armstrong College, Newcastle.

Fig. 8.—Some of Messrs. Reyrolle's Visitors.

Meanwhile, a subsidiary party had gone to the pit-head of the Blackhall Colliery of Messrs. Horden Collieries, Ltd., where tea was served by the Company, which also facilitated the visitors' descent to part of the underground workings. Situated on the sea coast about five miles north of Hartlepool, the sinking of this pit through heavily watered strata was completed in 1913; the colliery is electrically driven throughout in conjunction with the Horden and Shotton pits, which were already supplied with electricity by the Cleveland and Durham Electric Power Co. Turbo-generators are installed at both places, driven by exhaust steam from the winding, fan, and other steam engines, and operate in parallel with the C. & D.E. Power Co.'s system, which carries the peak load and into which surplus electricity is delivered by the colliery plant. The incoming 20,000-volt supply is delivered to the sub-station by three separate feeder cables and stepped down to 3,000 volts by means of three 1,500-kW transformers, all motors over 50 h.p., including those driving the winders, fans, and air compressors being operated at 2,900 V, 40 cycles, 3-phase; smaller surface motors are supplied from two 200-kVA 2,900/440-volt transformers. Two 100-kVA and one 200-kVA motor-generator sets have been installed for lighting purposes, and the larger electrically-driven equipment includes Belliss & Morcom air compressors (two of 535 b.h.p. and one directly driven by a "Metrovick" 1,175-b.h.p. motor), two 350-b.h.p. fans, three Sulzer centrifugal pumps of 710 b.h.p., one 125 and one 100 b.h.p. endless-rope haulage systems, and a 300-b.h.p. main and tail haulage set, whilst the screens, washery, saw mill, and fitters' shop are also motor driven. The electric winders at the North and South pits are duplicate Metropolitan-Vickers-Markham sets: their 1,500-h.p. motors operate at 2,700 volts, 3-phase, 40 cycles, with Weir liquid controllers and oil-immersed reversing switches.

To comply with the request for one free evening during the week, no formal plans were made for the Wednesday evening, which enabled a number of the visitors to the Deanery to remain longer in Durham City, a centre of learning and the mining industry, to see more of its cathedral and castle. Situated together upon an eminence within a horseshoe bend of the River Wear, the old castle was built to protect the Benedictine Abbey from attack, and was for centuries the fortress of the Prince Bishops of Durham, who possessed exceptional power and privileges, many of which were ceded to the Crown in 1836, and in that year the Castle was appropriated to the uses of the University of Durham, which was founded in 1832. Parts of the first castle, still extant, are acknowledged to be some of the finest ex-

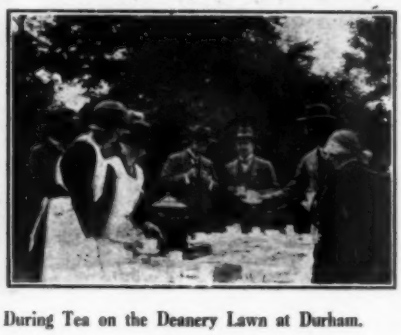
amples of early Norman architecture, whilst the cathedral is of magnificent proportions; it is the shrine of the northern Saint Cuthbert, commenced in 1093.

On the Thursday one party toured the Ford potteries of Messrs. C. T. Maling & Co., Ltd., who claim to be the oldest private firm of white earthenware manufacturers in the British Isles; the business was started 165 years ago, and the "A" pottery, which has converted 120 tons of clay into nearly half a million pots per week, has been entirely driven by electric power for the last 25 years, the largest grinding motor being of 200 h.p. All the machinery in the "B" pottery is now also electrically driven, over 60 motors of from 50 h.p. downwards being in use, the plant being capable of converting 200 tons of clay into nearly a million articles of ware per week. Messrs. Maling are said to be pioneers in the use of leadless and innocuous glaze, which has been employed by them for at least 27 years. They

Figs. 9 and 10.—In the Precincts of the Deanery at Durham Cathedral.

were the makers of the handsome souvenir ware distributed to each participant in the I.E.E. meeting this year.

An alternative Thursday morning visit was to the Elswick works of Messrs. Sir W. G. Armstrong, Whitworth & Co., Ltd., which for a period of 37 years supplied an unbroken line of chief constructors to the British Navy, a remarkable record. The present works of the Company at Elswick, Scotswood, and Openshaw (Manchester), and the shipyards cover more than 300 acres (200 shops), and can normally afford employment for 23,000 people, which figure was at times trebled during the late war. H.M.S. *Nelson*, the largest and most up-to-date warship completed recently, happened to be lower down the river at the time of the visit. The Elswick works were started in 1847 to manufacture



Figs. 11, 12 and 13.—Snapshots During Tea on the Deanery Lawn at Durham.

hydraulic cranes, and bridge and other constructional work was also undertaken. The Company's first connection with the War Office was in 1854, and the first three-pounder breech-loading rifled gun is still preserved and may be seen at Elswick. In 1863 British Government orders ceased, and W. G. Armstrong and Co. and the Elswick Ordnance Co. were amalgamated under the title of Sir W. G. Armstrong & Co., and directed their energies towards the acquisition of a foreign connection for ordnance. It was not possible to manufacture guns for long without becoming interested in warships, and shipbuilding was carried on at Elswick until 1918, when it became essential, owing to the increasing size of ships, to find a yard below the Tyne bridges, and in consequence the Armstrong yard came into being; apart from ships built during the late war, the new yard achieved some wonderful results in the repairing of damaged ships. In 1883 the steel works at Elswick were opened for the supply of gun steel, as well as of steel castings for marine, locomotive, and general engineering work. The steel foundry still continues, but the main supplies of steel are now furnished by the Openshaw works of the Company at Manchester. Acquired in 1897 when the business of Sir Joseph Whitworth & Co. was absorbed, the last-named works include the armour-plate plant as well as the machine tool and other departments. In 1897 works were started at Scotswood for the manufacture of ammunition, and since the late war have been reorganised for the manufacture of locomotives, marine, and gas and oil engines, as well as shell. In 1915 the works at Gateshead were purchased, and the subsidiary companies which have been acquired from time to time together normally employ some 30,000 workpeople.

After luncheon at the Grand Assembly Rooms, Newcastle, alternative visits on Thursday afternoon were to the Ford Potteries and to the fine recently-opened library of Armstrong College, Newcastle's seat of learning, which is an integral part of the University of Durham. The College was founded in 1871, and a special feature of the Electrical Engineering Department is the large use made of three oscillographs by students in every year. A recent gift is an experimental steam turbine, presented by Sir Charles Parsons, and the Dean Lake Laboratory of Electrical Engineer ing contains machinery aggregating 300 h.p. in small sets, transformers, and testing apparatus. The first experiments with high-voltage electroculture in this country were made 25 years ago in conjunction with the late Prof. Lemstrom by the Electrical Engineering and Botany Departments, whilst more recent work has been connected with the adaptation of electricity to coal mining, with the electrical ignition of gases, and dielectrics, with which Dr. W. M. Thornton is closely associated.

(To be continued.)

Swiss Railway Electrification.

Some particulars of the electrical equipment at, and constructional details of, the Seebach outdoor sub-station, one of 22 sub-stations which are being erected to supply 1,000 miles of route of the Swiss Federal Railways.

By H. W. SCHULER, Electrical Engineer, Swiss Federal Railways.

THE Swiss Federal Railways are electrifying their lines according to a programme which provides that by the end of 1928 one half of the system, including about 1,000 miles of route, will be entirely electrically operated. Over the electrified portion more than 75 per cent. of the whole traffic will be carried. Four Federal Railway power stations and two private companies will supply the energy for this service. Single-phase current at 15 kV will be generated by hydro-electric machines and transmitted to different feeding points, either by 15-kV underground feeders or 60-kV overhead transmission lines. The energy transmitted by the 60-kV lines will be transformed to 15 kV in 22 sub-stations distributed along the railway lines. Of these, five of the indoor type were built and equipped between 1919 and 1922; they are situated along the St. Gothard line between Lucerne and Chiasso. As the building costs of these were rather high, the type was abandoned in favour of the outdoor sub-station. First calculation and then experience showed that a saving of from 25 to 30 per cent. could be effected by installing all the h.p. apparatus and lines in the open. A reduction in the time expended in erecting the apparatus, the clear and simple lay-out of the h.p. lines and connections, and the ease with which extensions can be made are some of the advantages which were found to be inherent to outdoor sub-stations. Between 1923 and 1925 nine such sub-stations were built, and provision has been made for eight more to be put in operation.

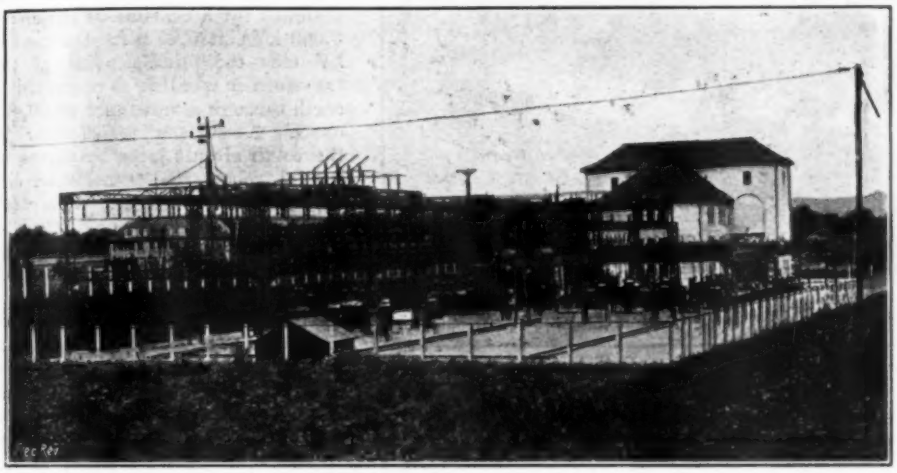


Fig. 1.—Seebach Outdoor Sub-station.

The sub-station at Seebach, fig. 1, which was ready for service in August, 1925, represents the most recent type of outdoor sub-station so far built on the system. The structure lies in a hollow, and the apparatus is partly concealed, a matter of great importance in Switzerland, and especially in the environs of Zurich.

A 60-kV transmission line, consisting of four 95-mm. copper cables, arranged in two independent loops, transmits the energy from the sub-station at Brugg, which is fed by a transmission line coming from the St. Gothard power stations. A branch line from this will supply the sub-station at Steinen. Space and apparatus are already provided for a transmission line to Gruze, where a sub-station is being built for feeding the lines going to the eastern part of Switzerland.

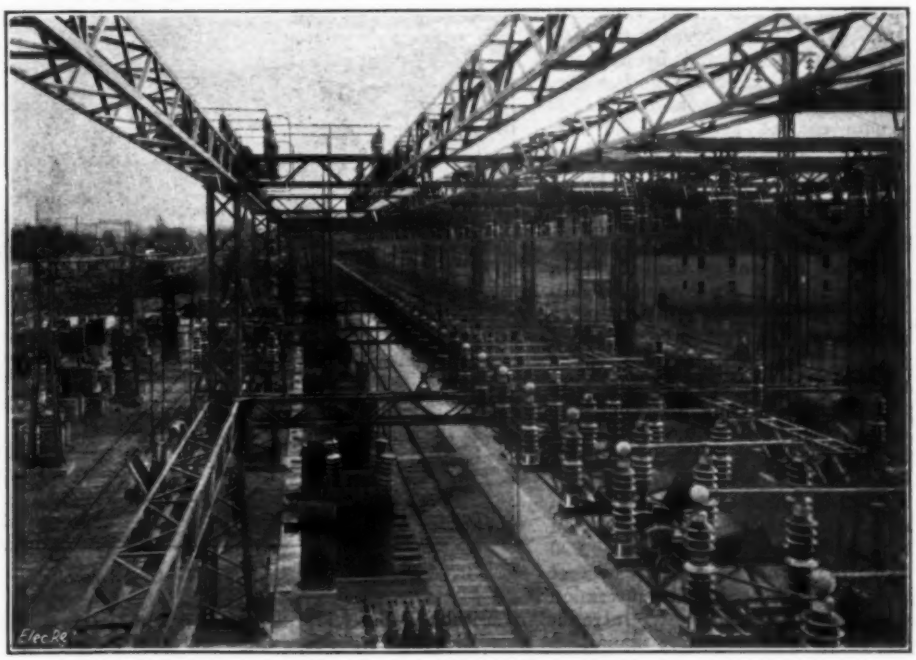


Fig. 2.—Switching Arrangements at Seebach.

The Seebach sub-station has to feed the contact lines of the different railroads branching off to the suburbs of Oerlikon. Duplicate bus-bars are provided. The transmission lines to Brugg-Rapperswill (Steinen) and Gruze are so arranged that one of their two loops goes to one half of the bus-bar system, and the other loop to the remaining section. By this arrangement numerous switching possibilities are given by which any service emergency can be met. Each transmission line

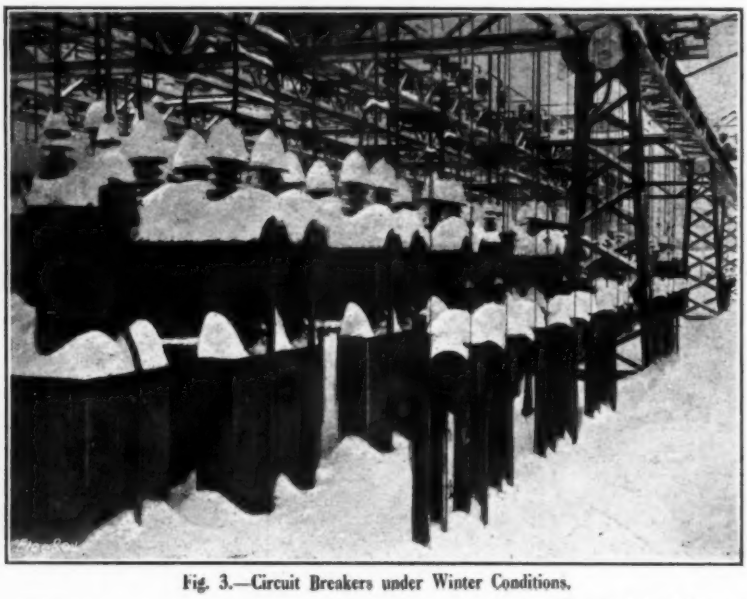


Fig. 3.—Circuit Breakers under Winter Conditions.

is equipped with pressure and current transformers for the measuring instruments and overload relays. Special earthing knife switches are also provided on the lines. Fig. 2 shows the switching arrangements; the transformers are connected to the two bus-bar systems in a similar manner to that employed for the transmission lines. The circuit breakers for the 60-kV lines and the transformers are designed to carry 200 A at 80 kV and to break a load of 450,000 kVA. They are constructed of two single-pole units coupled together by a suitable link connected with the operating mechanism. This mechanism, with the breaker-tripping apparatus, is mounted in a sheet-iron box separate from the breaker. Both hand operation and electrical remote control are provided for. The closing solenoid operates the breaker in half a second, its operating load being 38 A at 220 V. When opening the circuit, the breaker first inserts a 5,000-ohm resistance, and the remaining load is then interrupted by six contacts simultaneously. Each circuit breaker complete weighs 12,540 lb. and contains 4,840 lb. of oil. The 15-kV sides of the transformers are connected to the corresponding bus-bars by s.p. switches, the bus-bars being in turn connected to the contact-line bus-bars through main feeding breakers. These are designed for a working pressure of 24 kV, and have a breaking capacity of 250,000 kVA; they each have four contact bridges which operate in succession when opening the circuit, introducing suitable resistances at the intermediate stages. In parallel with each main feeding breaker is a 2,000-ohm testing resistance and the current transformer of an ammeter for indicating the line conditions when the breaker operates on short-circuit, and so preventing the closing of the breaker on "dead short." The resistance will carry its "short-circuit" load, 7.5 A, for 10 minutes without getting overheated. Should it become too hot, a maximum-temperature indicator will signal the abnormal condition to the operator.

The feeders to the different contact lines are branched off the contact-line bus-bar by means of small oil circuit breakers of limited breaking capacity. Each one of these lines can be earthed by a special knife switch, and sectionalising knife switches divide the bus-bars up according to the different railroad lines which have to be fed. In the case of a disturbance in one of the main feeding breakers, the line circuit breakers belonging to it can be connected to the next main feeding breaker by closing one of these knife switches. Fig. 3 shows these breakers under winter conditions. The single-phase transformers are designed for a continuous output of 3,000 kVA at 0.75 p.f. On the 60-kV side the middle point of the transformer winding is connected to earth through a resistance of 60,000 ohms. A current transformer in the earth circuit trips by means of special relays the transformer circuit breakers in the case of an earth developing on the line. On the 15-kV side one end of the winding is directly connected to the rails of the railroad passing by the sub-station. The windings consist of circular coils, concentrically arranged and held together by spring clamping rings. The end turns are especially heavily insulated to provide against damage due to excess voltages, the puncture voltage between turn and turn being at least equal to the line voltage. Resistance thermometers are installed in the upper coils of the 15-kV windings. Any serious change in the oil level in the transformer tank is automatically signalled to the switchboard operator. The bushings are filled with oil, those on the 15-kV side being in direct connection with the oil in the tank, those on the 60-kV side being separately filled with oil

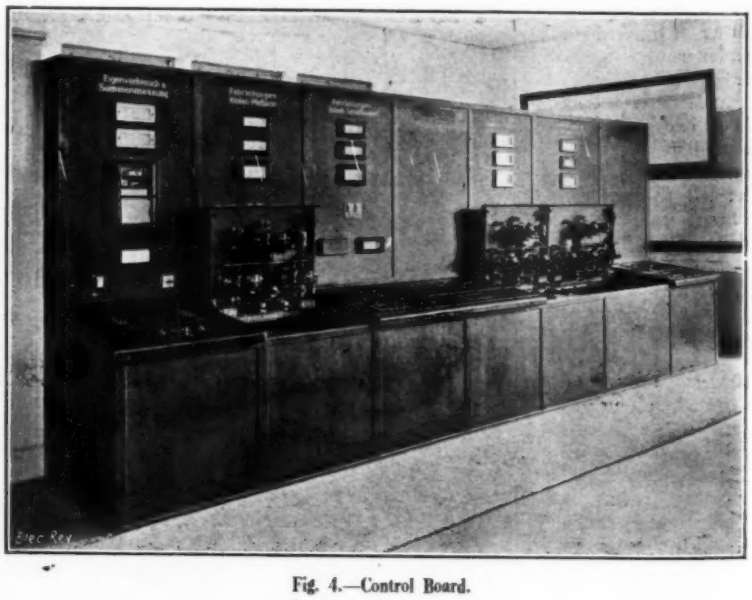


Fig. 4.—Control Board.

and provided with a top glass to allow for expansion of the oil. No special lightning arresters, either on the 15- or on the 60-kV side, are installed, so far with no serious consequences.

All the oil-containing apparatus installed outdoors is mounted on concrete foundations, while the knife switches and bus-bars are mounted on an iron girder

framework. The knife switches are operated from the ground by cables and levers. All the bus-bar and other h.p. connections are by means of copper pipes of 30-mm. external diameter. Tracks are led to each piece of heavy apparatus to facilitate its transportation to the repair shop, the concrete foundations being at a suitable level. All the girders and apparatus are earthed by means of copper strip.

The girder construction weighs over 100 tons and covers a surface of 25,000 square feet.

After the installation was completed, a pressure of 120 kV was applied to the 60-kV apparatus for from 10 to 30 sec. at intervals of 5 minutes. The 15-kV equipment was subjected to 50 kV for 5 minutes. The bushings and insulators had also to resist for 5 minutes testing pressures of 57.5 and 150 kV respectively, under a 45-deg., 4-mm.-per-min. rainfall.

All the measuring, signal and remote-control wires installed out of doors are lead-sheathed.

The switch-house is situated above the cable room and overlooks the whole of the outdoor equipment. Fig. 4 shows the control board for the 15-kV switchgear; signalling lamps and position indicators for the knife switches are so arranged as to represent diagrammatically the lay-out of the equipment. The auxiliary switchgear for the sub-station is mounted on a separate switchboard. Two 50-kVA, single-phase transformers give a 220-V supply for heating purposes and for two 20-kW motor generators for supplying d.c. A 220-V storage battery supplies the lighting and remote-control equipment, and a small 12-V battery serves for feeding the signalling circuits. A system of telephones connects the switchroom, the railroad, and the State system.

At present only three of the main transformers are installed, and two of the six transmission lines are in operation. Arrangements have been made to facilitate extending the sub-station, if necessary, in the future.

Ironclad Switching Systems.

A Review of the Subject from the Point of View of the User.

By a Supply-Station Engineer.

THE debate which has been started in the ELECTRICAL REVIEW regarding ironclad draw-out switchgear is one that interests every follower of progress.

It has to be borne in mind that Mr. Thomas Carter, M.I.E.E., in introducing the subject has limited his remarks to a certain range. Taking his first point, the superior mechanical principle employed, it must be admitted that less energy is required to remove a horizontal switch to the isolated position than in the case of the vertical type. This object is achieved at the expense of floor space.

Regarding the mass of the frames, in the vertical type, by reason of the increased height, the supporting structure has to be of fairly stout section to give the necessary stiffness; in the horizontal form, a cantilever construction has proved in the larger sizes of gear to be less economical than the form in which a frame of uniform section along the whole length of travel is used. When the question of accessibility is considered, such as attention to the contacts of an isolated switch, the tanks are removed by merely lowering them in the vertical type, which here possesses a great advantage; a small passage-way at the rear enables ready access to be obtained to all parts.

In the power station a separate supporting structure is not necessary for the vertical type; cross beams of suitable section forming the floor for an upper deck can be arranged in the design of the building. Guides similar to those used for lifts can be provided for the tanks, and very little obstruction to inspection is then experienced.

Work has to be done in the space between bus-bar and feeder orifices, and the selector plugs. In the case of the horizontal gear this is no easy job; one has for the moment to assume the attributes of a snake, which is a difficult task for those inclined towards rotundity. On this score the vertical gear, if provided with more than one point of access, is much better. Increased distance between orifices and plugs can easily be provided in the vertical gear.

With the usual constructions of horizontal gear, access to the back main contacts is difficult, and front access is obstructed by the presence of the lowering truck; hence the complete removal of the tank and obstruction of the passage during maintenance work is usually forced upon the operator. Self-contained lowering gear certainly modifies the case, but does not solve the other difficulties that arise.

The argument that both types need the same two plane motions is weak, in that whilst it embodies an undeniable truth, it is not practical. The complete removal of the tank or the circuit breaker in gear of good accessibility need only occur in a small percentage of the number of operations for isolating and inspection purposes.

In a large power station there is no great objection to the provision of a runway for a removal truck to run the whole length of the switchboard directly underneath the switch tanks of vertical gear.

It may be admitted that looking into orifices is easy on horizontal gear, but that is only part of the story; when all is said and done, how often does one need to look into these places? When work has to be done on these shrouded contacts, the complete removal of the horizontal switch is usually required; the vertical switch is merely lowered to the bottom or lowest position as a whole.

My previous remarks apply to the operation of earthing feeder contacts where through switch earthing has not been adopted, and to the cleaning or removal of plugs for selection purposes. Practical experience is here the only guide; if those who discuss this point say otherwise, they have surely forgotten theirs. Mr. Carter, when he speaks of the accessibility of horizontal-gear plugs, has in his mind only the single bus-bar type; accessibility is reduced when two or more bus-bars are installed, and on large gear access to the middle phase, bottom bus-bar selector plug is by no means easy.

The cable box of a horizontal switch is a neat arrangement and houses the necessary cable terminals and current transformers in a compact construction. If access to current transformers is desired, the designs at present made to provide this feature seem to indicate that the horizontal gear does not lend itself well to such a provision.

An easily accessible cable dividing box should help towards more satisfactory jointing, but beyond that, the situation of the box is not in itself very important. The important feature is the arrangement of the cable; sharp bending must be avoided.

To my mind the logical place for the cable runs of the vertical gear is overhead, with suitable protection against possible rising flames; the cables could be laid upon a concrete platform over the full width and length of the passage-way at a height level with the top of the bus-bars. The extra height need be little, and easy bends to the cable boxes, suitably designed, could readily be allowed.

The over-all height from the bottom of the cable basement need not be larger than from the floor level to the top of the cable chamber in the new lay-out.

In basements it is common practice to run the cables along the walls; in this case all the cables are liable to damage from fire at any one switch. If faced with the problem of installing either gear, whose service happens to be important, in limited headroom, I should consider the advisability of providing a cable passage of narrow width, with wall cleats for the cables, and a brick wall dividing the cable-way and switchroom. In the case of basements, if neither is provided with cable runs below the floor, horizontal gear may score by a foot or so in the matter of headroom. In the matter of the width required, horizontal gear is at a distinct disadvantage.

With regard to the question of damage to bus-bars, it is reasonable to expect that a serious explosion may cause damage to both types, as in either case the bus-bars are situated but a short distance away from the seat of trouble—the switch tank.

On vertical gear, failure of the top plate, or blow-off of the tank, is likely to do damage to the bus-bars. Perhaps, to meet this point, the bus-bars of vertical gear may be placed at one side and not vertically over the switch tanks; in this case, no inherent advantage of either type is of much importance. A failure from explosion occurs at the weakest point, and I see no reason why, with a clear space underneath, switches should seek heaven as their home. Overhead bus-bars are at a disadvantage when oil fires occur, and are then more likely to be damaged unless suitably protected. For those who prefer everything except bus-bars to be metal-clad (and recent installations demonstrate the existence of this school of thought), bus-bars can be mounted in cubicles on a floor above and the usual ironclad switchgear beneath; this should satisfy all doubts regarding the vulnerability of bus-bars.

In the event of severe electromagnetic forces, the bus-bars of the horizontal as well as the vertical gear are subject to reactive forces, which are equal and opposite; from a mechanical point of view the vertical downward isolating style can be designed so as to be capable of coping with the stresses in a direct line, but in present types of horizontal gear this is not so true.

The mounting of two circuit breakers in one tank does not give sufficient advantage to justify the extra outlay; it has disadvantages of great importance, neutralising to a large extent the value of the provision of duplicate bars.

Oil selector switches of good design are costly, and I hold that the capital is more economically spent on duplicate circuit breakers. Plug selection is slow in operation; speed in operation adds much to the value of duplicate bus-bar systems and speed in selecting is likely to be of increasing importance in power stations where the division of bus-bars has to be carried out. For important circuits, duplicate circuit breakers offer real advantages, and interlocking arrangements are less complicated.

If, on the occurrence of fire, it were feasible to play a hose upon the flames without causing damage to near-by switchgear, one could almost say that ironclad gear was as safe as could be. But talking of fires, whether likely or not, is disconcerting when the subject is switchgear, and perhaps not very tactful. Protection from dripping water is an inherent quality of the vertical gear; when dampness has to be considered, as is in some cases important, neither type scores.

The horizontal draw-out pattern was developed in the first instance, I believe, for single bus-bar systems; then their size was moderate, but now the largest are far from small. Switching practice is undergoing a change; the switch-houses of large power stations are designed to suit the gear, and a switch is now given a good deal of respect and is not put in an odd corner as heretofore. One or two feet of space must not unduly interfere with design.

Horizontal gear has served its users well, though its life has to a large extent been blighted for a long time owing to the disfavour shown to ironclad gear in the past. Vertical gear, with certain minor improvements in design, will, I think, take the field, albeit the rightful ground of the other's preparation, for the moderately large and super-power stations' requirements.

Where oil-filled gear is used, precautions must be taken, by division into compartments, to prevent any large quantities of oil running away from bus-bar chambers. Drains and channels in floors can help to prevent burning oil from spreading in the event of tank failure.

The two types have here been considered purely with regard to their inherent qualities; where present designs have been referred to, no one design alone has been held in mind.

I hold that the alleged weaknesses attributed to the vertical draw-out gear by correspondents are not incapable of improvement by design towards the attainment of a complete solution of all difficulties. The vertical downward draw-out is meant where not specifically mentioned. In conclusion, I would say, to preclude any suggestion of manufacturing interests, that I am not connected with any manufacturing concern—a fact which will, I think, be evident from the diversity of my criticisms.

Japan and the Electrical Industry.

By A. RIDDLE, A.C.G.I.

THROUGHOUT the short history of the electrical industry there is nothing to equal the rise of Japan as a power-producing country, or of its people as a power-using community.

Electricity is in general use, both for lighting and power, to an extent which, to the conservative English mind, is almost incredible. Throughout the whole country there is but one illuminant, and it is almost impossible to find a house which does not use electricity for lighting at least. In Tokyo itself, a city of two million inhabitants, the proportion of houses not wired for lighting is a negligibly small portion of 1 per cent. The same applies to the rural districts, where even the most distant settlement seems to get a connection on to a transmission line. Most of the house wiring, it is true, would not satisfy the demands of the English insurance companies, but this leads one to think that England perhaps is suffering from too much legislation in this respect. Throughout Japan all the dwelling houses are built of timber and paper; and in such a country, where the effects of a fire would be devastating, electricity is regarded as the only safe illuminant, coal gas being rightly regarded as a dirty, dangerous, and poisonous thing to have about the house. Further, the use of electric power is becoming more and more popular both for cooking and heating, and applications for connections are being received at such a rate that in many cases the supply companies are finding great difficulty in keeping ahead of the demand. Farmers, too, attracted by cheap rates, are rapidly adopting electric power for pumping, irrigation, sericulture, the tea industry, and in all the subsidiary agricultural operations.

The reason for such a general use of electric power is

apparent from a study of the physical characteristics of the country. Japan is a mountainous country with abundant water supplies, huge natural reservoirs, narrow gorges and countless waterfalls, so that it is one of the most easily adapted countries in the world for hydro-electric development, and something like 80 per cent. of the power generated in the country is developed hydro-electrically. There are some very fine examples of steam stations, but the majority of these plants are used for standing by, or for assisting at the low-water periods of the year. Transmission and distribution, too, present a much easier problem than in most countries, for by far the greater part of the population is congregated in the valleys, so that a concentrated load is almost always assured, and in no case is the load very far removed from the generating centre. In addition, there are abundant supplies of home-grown timber suitable for transmission lines, and copper is mined in quantities more than sufficient to meet all home demands. Endowed, then, by Nature with such resources and conditions, Japan has been enterprising enough to develop them to the full, with the result that ample supplies of cheap power are available everywhere, and further schemes are being projected to ensure adequate supplies of power in the future. The rate at which the demand for power is growing may be gauged by the fact that one company, the Tokyo Dento Kabushiki Kaishu (Tokyo Electric Light Company) has an available plant of 600,000 kW, which is almost double what it was before the great earthquake of 1923, and more than treble the figure for the early part of 1921. This figure of 600,000 kW is made up of 313,000 kW in hydro-electric stations, and 70,000 kW in steam plant, while the balance of 217,000 kW is purchased from subsidiary companies. The company owns over 2,000 miles of e.h.p. line and a further 48,000 miles of distribution line.

A study of the financial position of this company is of interest. The company commenced business some 40 years ago, and it now occupies the foremost position in the industry, with a stupendous paid-up capital of 345 million yen (10 yen equals £1 approximately), and incidentally it is the largest limited liability company of any sort in Japan. Although the amount of capital is not the only criterion of the position of the industry, it is indicative of its scope, and there are about 15 supply companies in Japan which have a paid-up capital of over ten million yen.

This company operates over an area of about 9,000 square miles in the Tokyo district, and has over 1¼ million lighting customers on its books, and a further 50,000 taking power. In spite of the magnitude of these figures, it is of interest to note that in April of this year the Ministry of Communications rejected an application from the company to extend its area of supply on the grounds that the power available is not, and has not been, sufficient to meet the demand. The view of this authority is that in 1929 there will be a shortage of power in the company's area; the reply of the company is that it is taking all steps necessary to ensure an adequate supply in the future.

A company of this size might appear to be too ponderous for successful management. Such, however, is not the case; for, while putting aside ample reserves, a dividend of 11 per cent. per annum has been maintained over the past three or four years. Indeed, this figure is just the average paid in 1926 by 18 of the largest supply companies whose financial position has been studied.

There are two systems in general use for charging purposes. One, a flat rate per mensem for a lamp of given consumption, which is accompanied by a reduction in the rate for an increase in the number of the lamps in use. The other system is the meter system, which promises in time to displace the flat-rate system entirely. The average charge for lighting is about 20 sen (about 5d.) per kWh, and for power about 7 sen (1.75d.) per kWh. These figures are for the small consumer. Big consumers are, of course, given special rates and so are the farmers. Farmers are given cheap rates owing to the fact that during the summer months, when the demand for power for domestic purposes is at its minimum, the rains are heaviest, and there is a big surplus of power available from the late spring until the early fall. It is just between these times that the farmer's need for power is greatest. By the organisation of a farm electrification society a campaign was started to educate the farmers concerning the possibilities of electricity, and the response has been extremely satisfactory.

Regarding the power plant in use, most of the Japanese engineers have a strong leaning towards American machinery, chiefly, perhaps, by reason of the large use of hydro-electric plant. Good examples of Swiss, German, and American water wheels are found, but one good station has four Pelton wheels, each rated at 10,000 h.p., by Boving. The Japanese manufacturers, however, are rapidly introducing their own designs, and in a few years outside manufacturers may experience great difficulty in finding a market for their products in Japan.

As far as steam plant is concerned, one hears nothing but praise for the British turbine and generator, while for steam raising, Babcock & Wilcox boilers are rightly regarded as the world's best. In one station at Nagoya, belonging to the Toho E.P. Co., were installed boilers by Messrs. Babcock & Wilcox, Ltd., generating 648,000 lb. per hour at 350 lb. pressure. These boilers are the largest ever erected in Japan, and it is the first plant to adopt high steam pressures. The generators were by the General Electric Co.—two of 35,000 kW each; but the station will have an ultimate output of 140,000 kW. It was cheering to see the condensers made by Messrs. W. H. Allen and British drive to nearly all the auxiliaries. The coal-handling equipment, however, was of Japanese design throughout.

The time taken to erect the station is worthy of note, as it is typical of the electrical movement in Japan. The design work of the stations was commenced in February, 1924, and the work of construction began in the following October. By October, 1925, the first 35,000-kW set was in commercial operation. This machine was dismantled after the shop test at Schenectady, and not only the windings of the stator, but also the laminations came separate from the stator casting. Those who are acquainted with the time usually required for setting up a big machine and putting it into operation will be interested to know that the entire work was completed in three months after its arrival in Japan.

Great attention is being paid to switchgear, which is nearly all of American make or made by Japanese affiliated companies, to American designs. Here, again, British manufacturers will have great difficulty in finding a sale for their goods in Japan owing to the lower price of the locally-built product. Nearly all the power is dealt with at outdoor transformer stations, as much as 200,000 kVA being operated at one such station, and Japanese-built switchgear up to 154,000 volts is giving excellent service.

The switchboards at all the modern stations are of the very highest class, and the designs generally show great attention to detail. One particularly good example of a Japanese-built board is at the Aso station for the Toho E.P. Co. The switchgear is controlled from a benchboard equipped with mimic buses and mimic disconnecting switches to facilitate speedy and accurate operation; and test terminals are provided so that all meters, instruments, and relays can be quickly and easily tested. Temperature indicators are also mounted on the control board so that the heating of the windings of the generators and transformers can be checked under all conditions.

As far as power cables are concerned, the market for British cable is practically dead. Paper cables are now being made in Japan up to 33,000 volts, and cables are being exported. One or two of the big power companies, however, placed useful orders for e.h.p. cables in German hands during 1926. The cable-making industry

is being pushed forward, and although the value of the cables imported during the past few years shows an upwards tendency, the increase is very small compared with the increase in value of the cables manufactured in Japan. The situation regarding insulated wires is even worse. The post-war figures for the value of imported insulated wires fluctuates considerably with a general tendency to rise, but the values in all cases are considerably less than the figures for 1912 and 1913, and this in spite of the enormous increase in the wiring business of the country.

The import figures for boilers and electrical machinery have shown a general tendency to increase during the past four or five years, and in view of the continued developments there should be good markets for all big plant for the next few years, but competition will be keen, not only with America, but with Japanese manufacturers as well. The local manufacturers are themselves building turbo-generator sets of 20,000 kW, and for marine work turbines of much greater output have been built.

Another department of the industry which has advanced considerably during the past few years is the manufacture of porcelain. The Japanese, for many centuries skilled in the manufacture of porcelain, have of late years turned their attention to the manufacture of high-quality electrical porcelain. Insulators for voltages up to 220,000 are being made by several firms, and the porcelain work is always of the best. The brown glazing, however, in some cases, is not up to the best standards, and the ironwork leaves a considerable margin for improvement. All the Japanese transmission lines up to the highest voltages are now fitted with locally-made insulators. 154,000 volts is the highest in operation at present, but lines at 220,000 volts are projected. An export trade is being built up, and there are increasing exports to India, Canada, and the United States.

Concerning the future there is still a great possibility for our manufacturers of large plant, as big developments are being projected for several years ahead. The Toho E.P. Co. is about to float a new company with the object of exploiting certain water resources. The scheme involves the construction of power plants with a capacity of 100,000 kW, together with transformer stations and transmission lines. The estimated cost of construction is 50 million yen for power stations and a further 10 million yen for sub-stations and transmission lines.

The Shinetsu E.P. Co. is also planning a hydro-electric station on the Shinano river, with a probable output of 160,000 kW; and the Tokyo E.L. Co. is preparing plans for a steam station on the outskirts of Tokyo with an output of 30,000 kW.

One of the last acts of the Ministry of Railways under the recently deposed Wakatsuki Cabinet was to sanction the expenditure of over 100 million yen on the development of several electric railways.

One of the direct results of these developments is that the Japanese, long seeking an outlet for their ever-increasing population, are turning their attention to an alternative by introducing new industries or developing old ones. The result is that the exports of the staple manufactured goods, particularly raw silk, cotton tissues and yarns, knitted goods, paper, pottery and porcelains, show a big increase over those of the past four or five years, and it is likely that this increase will continue.

True it is that Japan is at present passing through a financial crisis, but this could, and possibly should, have been met some four or five years ago. Some of the smaller banks are bound to crash, and some adjustment of economic conditions will follow, but this may leave the country in a healthier and fitter condition to compete for the world's trade.

British manufacturers should mark that these people, physically and mentally alert, and for centuries highly skilled as artisans, are determined to take a leading place amongst the manufacturing nations of the world, and that they are putting a tremendous energy into modern manufactures, with a decided inclination towards the electrical industry.

Wireless Batteries.

Some suggestions as to the correct methods of charging various types of batteries and of equipping a battery-charging depot.

By PAUL D. TYERS.

ALTHOUGH the actual charging of an accumulator is quite a simple matter, and should present very little difficulty even to those who have only a rudimentary knowledge of electricity, when one is confronted with the problem of charging a large number of wireless accumulators the procedure is far from straightforward.

The chief difficulty lies in the fact that the number and capacity of cells which have to be charged are never constant, thereby necessitating a considerable amount of flexibility in the charging plant. The position is further complicated by the fact that the trader may be called upon to charge simultaneously perhaps a six-volt 60-A (actual) cell and a two-volt slow-discharge small-capacity cell. Obviously, it is very inefficient to use the same plant for charging both types of cell.

When the available supply is d.c., the best method of charging a moderate number of batteries is, of course, to connect them all in series and simply put them across the mains in series with a suitable resistance, so that the charging current is reduced to the maximum charging rate of the smallest cell. The more nearly the total voltage of the cells in series approaches that of the supply the more efficient will the system become, in so far as cost of charging is concerned. If only a few cells were connected in this way a large amount of power would be lost in the series resistance, and the cost of charging two or three cells would be almost prohibitive. In fact, it would show no useful profit. If the charging rates of a number of cells are very different, it is once more inefficient to use a general series connection, reducing the charging rate to the maximum for the smallest cell, since the small cells would be charged long before the others. Very small cells, such as the well known Exide D.T.G. and D.F.G., are very conveniently charged from direct-current mains by connecting them in series with carbon-filament lamps, which can be paralleled until the desired charging current is obtained.

When the supply available is alternating current, much greater flexibility can be obtained. The current, of course, has to be rectified, and as there are so many forms of rectifiers or complete charging plants now on the market, each possessing some particular advantage, it will be advisable to consider them in some detail. Alternating-current charging plants can be roughly divided into three classes: motor generators or dynamos driven by a.c. motors; synchronous rectifiers; and dis-

charge tube rectifiers, such as mercury-vapour lamps or discharge tubes of the type used in the "Tungar" or Philips rectifiers. Should an a.c. motor be available, the simplest form of charging plant would probably be a shunt-wound dynamo driven by the motor. The output rate of the dynamo will be considered later in these notes. The synchronous rectifier is, in many respects, preferable to a motor generator, since it is less complicated mechanically. Moreover, it is somewhat easier to maintain in good running order, the only attention required being that of keeping the rectifying brush-gear and commutator clean. The output of a synchronous rectifier is also very easily controlled by the use of a suitably tapped transformer. There are several excellent plants of this description on the market at the present time, and they are supplied with the necessary switchgear. The third class of rectifier, the discharge tube, may be divided into two groups, the mercury-vapour lamp and other discharge tubes. Discharge tubes, such as the "Tungar" and Philips rectifiers, are incorporated in complete chargers, and are suitable for delivering comparatively small outputs. This type of plant is best suited to the dealer who has only a few cells to charge more or less regularly. Such apparatus possesses the advantage of requiring no attention whatever, since there are no moving parts. The mercury lamp is, perhaps, one of the best rectifiers to use when a large current is required. The writer has had experience of this type of apparatus working at fairly high currents, with very excellent results. One advantage of the discharge type of rectifier lies in the fact that if the supply fails, the cells cannot discharge through the apparatus, thereby obviating the necessity of complicated cut-outs or other form of protection gear.

One of the most important, and probably the most difficult, points to decide when installing a charging plant is that of its rating. The first step is obviously to estimate the number of cells that will have to be charged, and the number that may require to be charged at any given time, presumably, a full working day. The rating can then best be determined by adding about twenty-five per cent. to the total wattage which has to be dealt with during a full working day. Suppose, for example, this amounts to 500 W, one next has to consider how this output is to be delivered from the plant. For example, one might have a 50-V plant delivering 10 A, or a 25-V plant delivering 20 A. If all of the cells were to be charged in series, one would require a high-voltage low-current plant, while, if the cells were to be charged in parallel, the converse would be true. It has already been pointed out that where cells of various voltages and capacities will have to be charged, it is almost essential to utilise some form of series-parallel connection. In this case some compromise has to be adopted. For moderate-sized installations it is usually found convenient for the maximum current to be not more than twice that of the maximum charging rate of the largest cells which are likely to be obtained. If the number of cells is likely to be small, the amperage may then be conveniently chosen at a little more than the maximum for the largest cell. It is almost impossible to charge very small cells from a big plant with any reasonable degree of efficiency unless a comparatively large number can be connected in parallel. Charging stations which cannot conveniently reduce the rate below two or three amperes are well advised to charge small cells, such as the D.T.G. and D.F.G., from a large accumulator through a small regulating resistance. It is absolutely essential that this type of cell should not be charged at too high a rate.

Some care should be exercised in the layout of the charging system, the most desirable feature being that of the separation of the cells and bus-bars from the plant. A room in which a large number of cells is constantly being charged rapidly becomes filled with very corrosive acid fumes, and these are likely in time to damage the apparatus. If possible, the plant, switchgear, and other apparatus should be kept in one room, and the various bus-bars and accumulators located in another room, which should be well ventilated. A very good arrangement consists in taking the output from the rectifier through fuses and an automatic cut-out, if the rectifier is of the type requiring one, to a series of feeders, each provided with a switch, ammeter, fuse, and a small regulating resistance. These should then be led to the charging room, a common negative bus-bar being employed, and, preferably, differently coloured positive bus-bars being connected to the feeders.

The ideal position for an accumulator during charging, and one which is recommended by fire insurance companies, is upon a glass plate mounted on a lead-covered bench or shelf. If more than one shelf is used, the distance between them should be several feet, in order to minimise fire risk from celluloid cells.

No modern charging depôt is now really complete without facilities for charging high-voltage accumulators. Perhaps one of the best arrangements is the "Tungar" high-voltage unit, which utilises a high-voltage low-current valve. High-voltage accumulators are usually made up of medium-voltage units, and these can then be charged either in series or in parallel, according to the rating of the charging plant. If small h.p. accumulators have to be charged only on rare occasions, an ordinary thermionic rectifying valve, or two or three connected in parallel, may be used. The charging current for h.p. batteries is best regulated with a high resistance, and a high-reading milliammeter.

Apart from the actual electrical charging, it is very important to keep the cells in good chemical condition. On no account should acid be allowed to come into contact with brass terminals, and should this occur, the acid should be neutralised, and the terminals carefully washed and coated with vaseline. This is a most important point. The specific gravity of the acid should also be kept correct, and for this purpose a really accurate hydrometer should be used. Only best accumulator acid and distilled water should be employed, and a really good acid pump is certainly a necessity. There are, of course, many other accessories which are useful, such as apparatus for determining the leakage between adjacent celluloid cells by the manometer tube method. A really accurate low-reading voltmeter while, perhaps, not being a necessity, is an exceedingly useful adjunct to a well-equipped charging depôt.

Tramways and Light Railways Association.

The annual congress of the Association will be held at Bath next week. The chairman and directors of the Bath Electric Tramways, Ltd., will hold an informal reception on Wednesday evening, June 29th, and on Thursday, after a civic welcome by the Mayor, Alderman Cedric Chivers, J.P., and the Mayoress, Madame Sarah Grand, a paper on "Some Aspects of Local Passenger Traffic" by the late Mr. W. E. Hardy, M.B.E., managing director of the Bath Electric Tramways, will be read and discussed. Luncheon at the Grand Hotel will be given by the chairman and directors of the Bristol Tramways and Carriage Co., Ltd., and afterwards the members will visit Cheddar and Wells. On Friday the annual general meeting will be held, and a paper on "Modern Tramway Equipment" will be read by Mr. A. V. Mason, deputy general manager of the London group of tramway companies, and discussed. The members will be entertained at luncheon by the chairman and directors of the Bath Electric Tramways, Ltd., at the Guildhall. In the afternoon a visit will be paid to the Roman Baths and Pump Rooms, followed by a tour of the surrounding country. A reception at the Pump Rooms by the Mayor and Madame Sarah Grand, followed by an entertainment and dancing, brings the proceedings to a close.

Business and Industrial Notes.

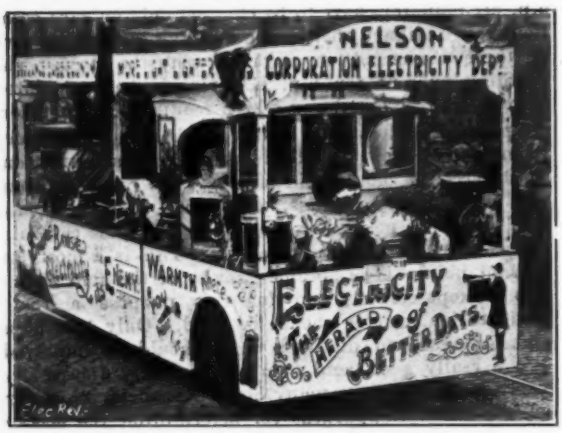
The Week's Electrical Trade News from all Sources. Commercial and Industrial Developments, Business Changes, Market Prices for Materials, Trade Openings, New Publicity Literature, Liquidations and Failures.

Our Trade Names Supplement.

The fifth of our Quarterly Supplements of Trade Names of electrical products accompanies the present number of the ELECTRICAL REVIEW.

A Travelling Exhibition.

The accompanying illustration shows how the Nelson Corporation Electricity Department camouflaged one of its vehicles upon the occasion of the Reedyford hospital gala and Lancashire fire brigade demonstration on June 11th. The skirting of the superstructure was illuminated with



A Gala Display by Nelson Electricity Department.

electrical slogans and the surrounding shelf bore examples of the usual domestic appliances. The display attracted a great deal of interested attention, and should result in more business for the Department.

Australian Demand for Increased Duty on Batteries.

Applications for increased import duties on electric batteries were made recently to the Australian Tariff Board. The Clyde Engineering Co. asked for the imposition of duties amounting approximately to 60 per cent. on British batteries and 72½ per cent. on others. The company's representative said that at present British batteries were imported at a price 15 per cent. lower than the Australian production cost. The annual requirement for motor-cars was about 60,000; if the duty was imposed his company would undertake to increase its plant, &c., within three months, to give an unlimited supply of batteries. Another company, On Masse Batteries, Ltd., promised to raise its production to 2,000 a week if duties of 47½ per cent. and 60 per cent. were imposed on British and other batteries. A representative of an American company said that Australian firms were assemblers rather than manufacturers, and he suggested a reduction in the present rates of duty. His company had abandoned the idea of erecting an Australian factory as the demand was not large enough to be remunerative.

Unemployment.

There was an increase of 104,187 in the number of registered unemployed during the week ended June 6th. At that date the total was 1,089,700, as compared with 985,513 on May 30th, and 1,609,119 on June 7th, 1926 (coal dispute period). The increase is attributed to the Whitsun holidays.

Radio Patents in Australia.

As we have already reported, large firms in Australia have challenged and have refused to pay the patent royalties charged by Amalgamated Wireless (Australasia), Ltd. *The Times* reports that before the Royal Commission on Wireless on June 15th, Mr. Fisk, the managing director, declared that the company had spent £200,000 on patents and research and had only received £76,000 from royalties.

The "Electrical Review" Index.

The Index to Vol. C. (for the half-year ending June 30th, 1927) will be published shortly, and we shall be glad to receive the names and addresses of those who require it (free of charge) for binding purposes, or wish to retain it for reference. Application should be made to the Publisher, 4, Ludgate Hill, E.C.

Employment during May.

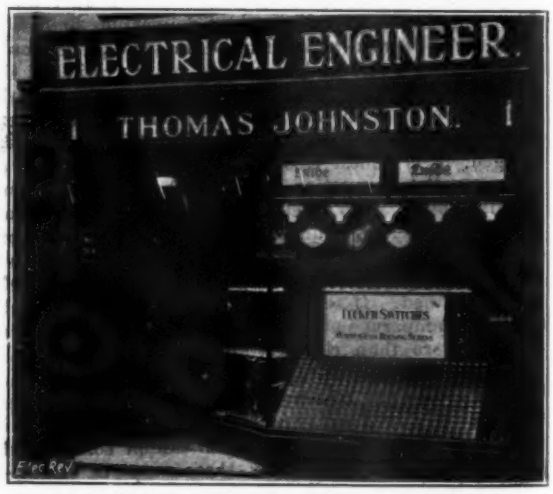
According to this month's *Ministry of Labour Gazette* employment in the engineering industry during May was still slack on the whole, but continued to show improvement in all sections; in the motor vehicle and electrical sections it remained fairly good. The "overall" percentage of unemployment in the industry fell from 9.7 to 8.7. The proportion in electrical engineering decreased from 5.6 to 5.1 per cent. There was an increase in unemployment in the electrical wiring and contracting industry—from 7.4 to 9.1 per cent. In the electrical cable, wire and lamp manufacturing group there was a slight improvement, the unemployment figure falling from 7.7 to 7.4 per cent. The actual numbers of unemployed in the branches of industry mentioned were as follows:—Engineering, 87,444 (including electrical engineering, 3,919); electrical wiring and contracting, 1,260; and electric cable, wire and lamp manufacturing, 6,476.

Local Exhibition.

SOUTHAMPTON.—The Corporation Electricity Department is holding a special fortnight's display of "Magnet" domestic appliances (General Electric Co., Ltd.), at its showrooms. "Magnet" appliances also figure in the displays arranged by the local contractors for the occasion.

A Tucker Switch Display.

A very effective display of Messrs. J. H. TUCKER & Co.'s tumbler switches has been made by Mr. T. Johnston, of Whitehaven, who recently received a contract to wire 108 houses upon the Corporation's Bransty housing estate. Mr.



Tucker Switches at Whitehaven.

Johnston has decided to employ Tucker switches exclusively. A view of Mr. Johnston's shop window showing the batteries of Tucker switches which are being used in the houses appears herewith.

Increased Austrian Duty on Insulators.

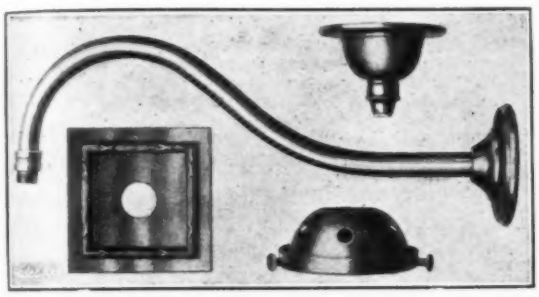
The Austrian Government proposes to increase the import duties on a number of articles, including shaped parts of insulating materials (except porcelain, glass and hard rubber) for electrical purposes, not equipped, weighing more than 600 gr. each. The proposal is to raise the rate from 25 to 60 gold kr. per 100 kg.

Electric Power in Industry.

Preliminary Report No. 15 upon the 1924 Census of Production was published with the *Board of Trade Journal* for June 16th. It shows that in the wall-paper trade there was 811 kW of generating plant, as compared with 850 kW in 1912. The aggregate capacity of installed electric motors was 1,678 h.p., and power for 1,683 h.p. of these was purchased. The capacity of the generating plant used by the fertiliser, glue, sheep dip and disinfectant trades rose from 870 kW in 1907 to 3,528 kW in 1924. There was a total of 23,606 h.p. of electric motors, power for 19,688 h.p. of which was purchased. There was a reduction in the capacity of generating plant installed in the starch, blue, and polish trades, from 970 kW in 1907 to 402 kW in 1924. The total electric motor horse-power was 11,922; power for 7,117 h.p. was purchased. There was 124 kW of plant in the packing trade, and 3,005 h.p. of electric motors (power for 2,982 h.p. purchased).

A Birmingham Fittings Factory.

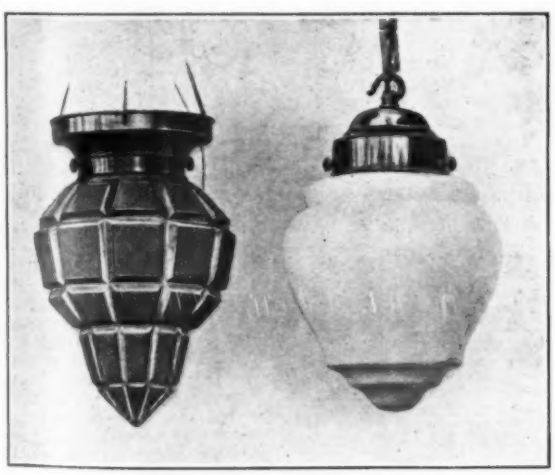
One of the most up-to-date factories for the production of electrical fittings is the St. George's Works of MESSRS. JOHN LAWTON & SONS, LTD., Harford Street, Birmingham. The company's resources enable it to carry out all the processes from pressing and spinning to electro-plating and polishing.



Electrical Fittings by John Lawton & Sons, Ltd.

A very wide range of fittings is produced; for instance, the company makes 160 varieties of switch plates, 40 types of brackets, 90 ceiling plates, and 60 galleries. The first illustration depicts an example of each of these fittings.

Typical lighting fittings manufactured by the company are shown in the second illustration. The left-hand pattern is



Two Totally-enclosed Lighting Units.

a totally-enclosed fitting of moulded glass for ceiling mounting; the other is also of the totally-enclosed dustproof type but of opal glass. The latter is provided with a chain of rectangular links, through which the flexible is threaded.

Patent Restoration.

An order has been made restoring Patent No. 200,963 of 1922, granted to M. W. W. Mackie, for "Improvements in Dynamos and Motors."

The Department of Overseas Trade.

The Parliamentary Correspondent of the *Daily Telegraph* says that the agitation for the retention of the Department of Overseas Trade appears likely to be successful, and Members of Parliament who have interested themselves in the matter feel that the battle is as good as won. In the case of the other two Ministries under sentence of extinction—the Department of Mines and the Ministry of Transport—the Government will, it is stated, stand firmly by its decision.

The Timber Market.

Our timber trade correspondent reports that the demand for all house and general building timbers, as well as for pine and spruce poles, continues to be well maintained. Stocks of such woods at docks, prior to the opening of navigation, had declined considerably in volume; the new arrivals, however, will soon bring them up once more to the general average of the past six years, although the better demand should not make stocks unwieldy throughout the summer. The hardwood market, although showing a lack of activity, is firm, as with the exception of American supplies, stocks are from low to moderate. With the expected decline in receipts from the United States, however, in consequence of the floods in the Mississippi Valley, the hardwood market is likely to show still further firmness.

Wages in the Engineering Industry.

The unions concerned in the negotiations for increased wages in the engineering industry have issued ballot papers to their members for voting upon the employers' offer of 2s. per week increase to plain time workers. The executives of the unions are leaving the matter solely in the hands of their members, making no recommendation for either acceptance or rejection. A bare majority will be sufficient to carry the proposal and the papers are to be returned by July 20th.

A meeting of the London Joint Engineering Trades Committee was to be held this week to consider the situation.

Electricity in a Birmingham Carnival.

On June 11th a flag day and carnival were held in aid of the Birmingham hospitals and the City Electric Supply Department took advantage of the opportunity to make a display of domestic appliances. This was mounted on a lorry, as shown in our illustration, and comprised a cooker, geyser, wash-

Display by the Birmingham Electric Supply Department.

boiler, radiators, kettle, iron, toaster, coffee percolator, fan and lighting fittings. The superstructure was inscribed with electrical slogans.

Southend Traders and Municipal Showrooms.

The Southend, Westcliff, and District Chamber of Trade has sent a letter to the Town Clerk suggesting that if electricity showrooms are erected they should not be used as sale rooms, as electrical traders of the borough had satisfactorily supplied past demands for electrical fittings and appliances, and also for the wiring of houses, &c.

Trade Announcements.

Mr. H. WORTON, of Trinity Square, Nottingham, has opened a branch of his electrical business at the Crescent, Spalding.

The PARSONS OIL ENGINE CO., LTD., has opened an office at 3, Victoria Street, S.W.1 (telephone: Victoria 2525). This office will be in charge of Mr. C. Wright.

Mr. GEORGE D. JONES, electrical engineer, late of F. J. Jones and Sons, of The Eastgate, Chester, announces that he is continuing to carry on business at 6, Seller Street, in the city.

Mr. J. H. MOORES, who has represented the Igranic Electric Co., Ltd., for some years in the North-Western counties, has joined the staff of Messrs. John Moores & Co., Ravald Street Works, Salford, manufacturers of insulating materials.

LIGHTING TRADES, LTD. (incorporating J. & W. B. SMITH, LTD.), has removed its offices to Oriel House, 30-31, Farringdon Street, E.C.4. The company's showrooms are nearing completion.

MESSRS. PARMITER, HOPE & SUGDEN, LTD., have appointed Mr. J. A. Anderson, 1, Eldon Square, Newcastle-upon-Tyne, as their sole representative for the North-East Coast district. He is handling the sales for this district of their Aeroflex h.p. and l.p. fuse-gear, and other products.

Messrs. J. MACGREGOR & CO. have removed to 4, Denmark Street, Charing Cross Road, W.C.2. 'Phone: "Gerrard 7302-7308."

D

New Catalogues and Lists.

The VISCO ENGINEERING CO., LTD., 162, Grosvenor Road, S.W.1.—A pamphlet advertising the "Visco" air filter for motor vehicles, &c.

The ELECTRICAL EQUIPMENT & CARBON CO., LTD., 109-111, New Oxford Street, W.C.1.—List No. S.C.9, giving details and prices of "Siemens" therapeutical carbons.

Also a monthly stock list of motors, generators, bell transformers, carbons, &c.

The RELIANCE TELEPHONE CO., LTD., Goschen Buildings, 12-13, Henrietta Street, W.C.2.—A cut-out advertising the company's intercommunication systems—installation and maintenance.

MESSRS. GENT & CO., LTD., Faraday Works, Leicester.—An illustrated and priced catalogue dealing with "Tangent" electromotor sirens for works, &c.

METRO-VICK SUPPLIES, LTD., Trafford Park, Manchester.—Folder No. 4140/4, advertising "Cosmos" fans; also a photograph of a window display for the use of dealers in these fans.

TURNER BROS. ASBESTOS CO., LTD., Rochdale.—A card advertising ebony "Sindanyo" insulating board for switch panels, &c.

The CRESSALL MANUFACTURING CO., LTD., 31 & 32, Tower Street, Birmingham.—Leaflet E.F.B.1927, illustrating and describing the "Cressall" electric fire bar. Priced.

AUTOMATIC & ELECTRIC FURNACES, LTD., 173-175, Farringdon Road, E.C.1.—Bulletin No. 38, "The Correct Hardening of Tool Steel," by A. R. Page, giving the results of experiments with a Wild-Barfield electric hardening furnace.

SHEFFIELD STEEL PRODUCTS, LTD., Templeborough Works, Sheffield.—A reprinted article upon the manufacture of files by the company.

SIEMENS-SCHUCKERT (GREAT BRITAIN), LTD., 109, Kingsway, W.C.2.—An illustrated pamphlet advertising the company's automatic intercommunication system.

MESSRS. J. G. STATTER & CO., Queen Anne's Chambers, Westminster, S.W.1.—Leaflets No. X203a, dealing with a.c. and d.c. circuit breakers for currents up to 1,000 A, and No. X225, describing ironclad circuit breakers (Home Office type). Illustrated and priced.

The IGRANIC ELECTRIC CO., LTD., 147, Queen Victoria Street, E.C.4.—An illustrated brochure dealing with the construction and operation of the company's seven-valve neutrosonic radio receiver. Particulars of accessories are also included.

W. T. HENLEY'S TELEGRAPH WORKS CO., LTD. (Engineering Department), Holborn Viaduct, E.C.1.—A small priced booklet advertising the company's plywood backboards. It has stiff covers forming a reproduction of one of the boards.

MESSRS. JAMES MCMILLAN & CO., Clun House, 17, Surrey Street, W.C.2.—A pamphlet describing "Pripp" electric lighting fixtures for sewing machines.

MESSRS. HOPKINSONS, LTD., Britannia Works, Huddersfield.—Three illustrated pamphlets dealing respectively with a steam isolating valve, the "Hopkinson-Ferranti" valve, and the "S.P.S." valve.

The PLAN CLIP CO., 4, St. Paul's Churchyard, E.C.4.—A booklet dealing with a system of filing drawings, blue prints, &c.

The BRITISH THOMSON-HOUSTON CO., LTD., Crown House, Aldwych, W.C.2.—An illustrated pamphlet containing full details and prices of a new series of 2-V valves. Also copies of the instruction sheets which are packed in the cartons.

Dissolution of Partnership.

POTTS & CO., electrical and mechanical engineers, Longton, Stoke-on-Trent.—Messrs. W. J. Potts, A. L. Vass, and D. Humpherson have dissolved partnership. Debts will be attended to by Mr. T. N. Elliott, District Bank Chambers, Longton, the receiver.

Bankruptcy Proceedings.

J. TURNER, 62, Blackburn Road, Great Harwood, Lancs., electrician.—The receiving order in this matter was made recently on debtor's own petition. The statement of affairs shows liabilities of £855, against net assets of £294. The first meeting of the creditors was held recently at the Official Receiver's office, Preston. The following are creditors:—

	£		£
Beardsall, E., & Co., Ltd.	31	General Electric Co., Ltd.	88
Beaten Metal Co.	26	W. T. Henley's Telegraph Works Co., Ltd.	45
Baxendale & Co., Ltd. ...	65	McGrath, J. & J.	44
British Insulated Cables, Ltd.	19	Northern Steel & Hardware Co., Ltd.	76
Crypto Electrical Co., Ltd.	48	Turner (Mrs.)	260
Palmer, Riley Co., Ltd.	28		

T. W. THOMAS, trading as T. W. Thomas & Co., electrical contractor, Clarendon Road, Middlesbrough, Yorks.—The public examination of this debtor was held recently at the Court House, Middlesbrough. Debtor's liabilities were put down at £916, against assets of £317, leaving a deficiency of £599. Debtor attributed his failure to bad debts and lack of capital. The examination was adjourned.

J. TURNER, 62, Blackburn Road, Great Harwood, Lancs., electrician.—The public examination of this debtor was held on June 15th at the County Court House, Blackburn. The statement of affairs showed liabilities of £856, against assets of £295. Debtor attributed his failure to the illness of his wife, heavy household expenses, keen competition, and insufficient work. The examination was closed.

T. F. COLLIER, Union Street West, Oldham, electrician.—The adjourned public examination of this debtor was held recently at the Court House, Oldham. The Official Receiver stated that the debtor had been asked to amend his statement of affairs, but there was some difficulty with regard to it. Debtor said he would be able to pay his creditors 20s. in the £, but he was told that he should enter all the items in the account and stipulate which were disputed. The examination was therefore adjourned.

J. STEPHENSON (J. Stephenson & Son), plumber and electrician, 36 and 37, Flowergate, Whitby.—Trustee, Mr. M. W. Chapman, Golden Lion Chambers, Whitby, appointed June 13th.

D. M. STRODE, engineer, 44 to 50, Osnaburgh Street, N.W., and 6 and 7, Creed Lane, E.C.—Last day for proofs for dividend, June 30th. Trustee, Mr. E. H. Hawkins, 4, Charterhouse Square, E.C.

W. T. SMITH, electrical and mechanical engineer, 60, Hampden Street, Bolton.—Last day for proofs for dividend July 2nd. Trustee, Mr. J. G. Grant, Senior Official Receiver, Byrom Street, Manchester.

G. S. HALL (G. S. Hall & Co.), electrical engineer, 55, Malden Road, New Malden, and late of 8, Malden Road.—Receiving order made June 15th, on a creditor's petition. First meeting, June 28th, public examination July 29th, both at Carey Street, W.C.

J. T. NICHOLS, 4, Glebe Road, Kingsland Road, Dalston, and Rye House, Highams Park, wireless parts merchant.—Receiving order made June 15th on a creditor's petition. First meeting, June 27th, public examination, July 29th, both at Carey Street, W.C.

J. SPAVEN, electrical and mechanical engineer, 51 and 53, George Street, Bradford.—Receiving order made June 15th, on debtor's own petition.

W. A. BARKER and F. G. H. BARKER (Barker Bros.), electrical engineers, 554a, Dudley Road, Wolverhampton.—Receiving order made June 14th, on debtors' own petition.

H. A. SANDERS, electrical contractor, The Black Cat Restaurant, Chawston, Beds.—Last day for proofs for dividend, June 24th. Trustee, Mr. H. Ball, Duke Street, Bedford.

C. HUBBARD, electrician, 13, Magdalen Street, Norwich.—Second and final dividend of 2s. 8d. in the £, payable at the Official Receiver's office, 9, Queen Street Chambers, Norwich.

G. C. LAZENBY, wireless engineer, 29, Old Town Street, Plymouth.—First meeting held June 21st, at 11, St. Aubyn Street, Devonport. Public examination, July 22nd, at the Western Law Courts, Guildhall, Plymouth.

G. J. C. THORNE and A. H. THORNE (Lawrence Electrical Trading Co.), electrical engineers, late of 159, High Street, Notting Hill, W.8.—Trustee, Mr. D. Williams, Official Receiver, Carey Street, W.C., released June 9th.

Company Liquidations.

ELECTRICAL WHOLESALE SUPPLIES (LEICESTER), LTD., 58, Halford Street, Leicester.—A meeting of creditors was held recently at 25, Friar Lane, Leicester, when Mr. J. A. Hopps, the liquidator, submitted a statement of affairs which showed ranking liabilities of £1,929. The indebtedness to the trade was £1,028, and there were cash creditors for £901. The net assets were £398, leaving a deficiency of £1,531. Mr. Hopps reported that the company was registered on July 3rd, 1924, with a nominal capital of £3,000. The issued capital was £1,050, and those shares were allotted in equal proportions amongst Messrs. G. H. Gelsthorpe, T. Gelsthorpe, and J. T. Kemp, who had acted as directors. During the first year the turnover was £5,489, and there was a net loss of £97. In the following twelve months the turnover fell to £4,856, with a net loss of £602. Between July and December of last year the sales were only £1,167, and there was a loss of £925. During the present year there had been a further loss on the trading of £494. A resolution was passed confirming the voluntary liquidation of the company with Mr. Hopps as liquidator. The following are creditors:—

	£		£
Woolf, Arnold	30	Perfecta Seamless Electric Cables, Ltd. ...	73
Kemp, J. T., Ltd. ...	382	Tubes, Ltd.	96
Midland Manufacturing Co.	22	Standard Metals, Ltd....	64
Armorduct Cable Co. ...	41	Smith, J. & W. B. ...	36
L. Mitchells & Son ...	35	Balkan Electric Co. ...	32
		Pooley, H., & Son ...	21
		Hopps & Bankart ...	26

DE LEEUW & CO., LTD., Sentinel House, Southampton Row, W.C.2.—Under the compulsory winding up order made against this company last October, the report of Mr. J. Barwick Thompson, Official Receiver and liquidator, has been issued to the creditors and shareholders. The accounts lodged show liabilities of £2,269, against assets valued at £191, and a deficiency of £5,178 as regards contributions. The Official Receiver reports that the company was registered as a private company in April, 1925, with a nominal capital of £500, increased in January, 1926, to £10,000, and was formed to carry on business as general agents, dealers in radio appliances, electrical apparatus, &c. The company acquired Mr. Henry De Leeuw's in-

terest in certain agency agreements, the purchase price of £500 being satisfied by the allotment of shares. The business was confined principally to the sale of Freed-Eismann wireless sets and components. An agreement stated to have been entered into with that company cannot be traced; Aldis (a director) states that it was last in the possession of De Leeuw. In or about October, 1925, De Leeuw proceeded to America with the object of obtaining confirmation of the agreement with the Freed-Eismann Company. For this purpose, a sum of £200 was borrowed from a moneylender and subsequently repaid. In March, 1926, De Leeuw obtained from another moneylender sums amounting to over £500 against cheques drawn on the company's banking account. The directors state that this was done without their knowledge. White (a former director) states that the moneys were used by De Leeuw to acquire 500 preference shares of the company. Further moneys amounting to £200 were borrowed in April, 1926, from another moneylender who subsequently presented the petition upon which the winding-up order was made. Both De Leeuw and White signed the promissory note; Aldis denies any knowledge of the transaction. Proceedings were commenced against the company and in July, 1926, judgment for £230 was obtained against the company, De Leeuw and White. Owing to the unsatisfactory financial position of the company which had been brought about by the transactions entered into by De Leeuw, he was requested to resign. The board then instructed the company's auditors to investigate the position and to prepare accounts, and extreme difficulty had been experienced. It appears, however, that the trading from the date of incorporation to May 22nd, 1926, resulted in a net loss of £1,930. Included in the accounts is a sum of £994, representing moneys drawn from the company's funds by De Leeuw which he had not satisfactorily accounted for. De Leeuw has left the country and is believed to be in Holland. The failure of the company is attributed by White to extravagance on the part of De Leeuw and to heavy overhead charges. In the opinion of the Official Receiver the failure is due to the moneylending transactions entered into by De Leeuw, and to the depletion of the company's funds by moneys received by him for which he has not accounted. The failure was contributed to by the omission of the other directors to exercise any control over De Leeuw.

NEUTRON, LTD., Sentinel House, Southampton Row, W.C.—The report of Mr. J. Barwick Thompson, Official Receiver, upon the liquidation of this company has been issued. The statement of affairs discloses total liabilities of £9,534 (unsecured £8,092); assets valued at £1,441; and a deficiency of £8,592 with regard to contributories. The company was registered as a private company in May, 1924, with a nominal capital of £500, its objects being to carry on business as manufacturers and buyers and sellers of substances used as crystal detectors, and in particular the crystal known as "Neutron." The company acquired the goodwill and assets of a business carried on by Bennison and De Vries. The consideration was fixed at £394, which was satisfied by the issue of fully-paid shares. Bennison acquired 135 shares, and transferred them to W. Wolsey, a director, in July, 1926. Later, three debentures for £100 each were issued to Bennison for moneys alleged to have been advanced by him. It appears that at the date the debentures were issued the company owed Bennison about £50 only, and later the company lent to him £350 and a further sum of £120. In March, 1926, Bennison appointed a receiver and manager on his behalf, and he acted as such until July, 1926. Wolsey states that shortly after the incorporation of the company Bennison approached him as a partner of the firm of V. Zeitlin & Sons with a view to obtaining financial assistance, and in the result an agreement was entered into whereby Zeitlins were appointed sole distributors for Great Britain and Ireland of "Neutron" crystals. There were agreements with other firms for distributing crystals, and the position with regard to these will require the consideration of the liquidator. In April, 1926, other debentures for £1,000 were created, and on the same date a debenture for £250 was issued to Fitton Smith and Co., Ltd., for cash. In May, 1926, it was reported at a board meeting that Fitton Smiths had made further advances amounting to £915, and a debenture for £900 was issued. It was also reported that Fitton Smiths had endorsed one of the company's bills for £400 and had guaranteed a debt of £633 due by the company, and a further debenture for £1,000 was issued. Later, a further debenture for £400 was issued to Fitton Smiths in respect of an advance made by them, with the result that they held debentures totalling £2,550. The company's borrowing powers were limited to the amount of its issued capital, and questions arose as to the validity of the debentures. An extraordinary meeting was held, at which a resolution was passed authorising the directors to borrow to the extent of £5,000. At the same meeting it was resolved that debentures for £3,150 should be issued to P. G. Marr & Co., Ltd. (the successors of Fitton Smith & Co., Ltd.) in settlement of the moneys due to them in respect of the £2,550 debentures previously issued and other moneys advanced. As those debentures were issued within three months of the commencement of the winding-up for a past consideration, they would appear to be void. In November, 1926, the creditors were asked to accept 3, 6, 9 and 12 months' bills in respect of their claims, but the proposals fell through. In these circumstances Marrs declined to finance the company further. There were a number of judgments against the company, and in January last it was decided to put the company into voluntary liquidation. On the same date Bennison appointed a receiver on his behalf. At an extraordinary meeting a resolution for the appointment of Mr. M. D. Booth as voluntary liquidator was proposed, but was not carried, and on January 28th a creditor presented the petition upon which a winding-up order was made on February 15th, 1927. On February 17th, 1927, P. G. Marr & Co. appointed a receiver. At a later date the receiver on behalf of Bennison retired; the receiver appointed by P. G. Marr & Co. had not taken any action. The trading account shows that the net sales amounted to £68,588, and there was a gross profit of £16,828, which is carried to the deficiency account. Wolsey attributes the failure of the company to excessive advertising and to extravagant management. In Bennison's opinion the failure of the company is due to excessive advertising and insufficient working capital. He also states that the company kept a large and expensive staff and incurred losses in connection with wireless sets. The Court, on March 7th, appointed Mr. M. D. Booth, chartered accountant, of 40-43, Norfolk Street, Strand, London, W.C.2, liquidator of the company with a committee of inspection.

YATES & THOM, LTD.—Winding up voluntarily. Liquidators, Mr. F. Thom and Mr. W. H. Davies, Canal Engineering Works, Blackburn. Meeting of creditors, July 1st, at Canal Engineering Works. Particulars of claims to the liquidators by August 2nd. (This notice is formal, all creditors have been, or will be, paid in full.)

MANDA MOTORS, LTD.—A meeting of members is called for July 18th, at the offices of Messrs. Fincham, Partridge & Co., 3, Warwick Court, Gray's Inn, W.C., to hear an account of the winding up from the liquidator, Mr. A. H. Partridge.

ALKLUM ELECTRICS, LTD.—Liquidator, Mr. T. W. Meldrum, Portland House, 73, Basinghall Street, E.C., released June 3rd.

ELECTRICAL ENGINEERING & EQUIPMENT CO., LTD.—A meeting of members is called for July 18th, at the office of Messrs. Deloitte, Plender, Griffiths & Co., 5, London Wall Buildings, E.C., to hear an account of the winding up from the liquidator, Mr. R. Kettle.

Private Arrangements.

A. E. HUMPHREYS, 20, St. James' Square, S.W.1, electrical engineer and contractor.—A meeting of creditors was held on June 13th, when it was stated that the liabilities to creditors amounted to £2,640. The assets at cost figures were said to total £1,379. The debtor started business in November, 1925, with a capital of £250, borrowed from five persons; the whole amount was still owing. The sales and work done up to the current month had been £6,054. There was a gross profit of £457, and the office expenses had been £398. The drawings of Mr. Humphreys were £814 and the salaries had been over £5 weekly. The debtor had done considerable work at Thorne and Ashton-under-Lyne, and there was still work in hand. The debtor had been contracting for some time for fitting electrical apparatus in houses. Six or seven writs had been served on him, and a bankruptcy notice. The debtor had been working under contract for some time for the House Builders' Association, and the secretary of that concern said that the Association would continue to give the debtor contracts if he were allowed to carry on. No definite resolution was passed; the opinion was expressed that the matter should be dealt with privately. The following are creditors:—

	£		£
British Insulated Cables, Ltd.	148	Siemens Bros. & Co. ...	118
Tucker, J. H., & Co., Ltd.	27	Borman & Co., E. ...	144
Callender's Cable & Construction Co., Ltd. ...	137	Sharp & Fisher	25
Baxter & Caunter, Ltd.	41	General Electric Co., Ltd.	120
Electrical Conduits, Ltd.	132	White, W., & Co.	343
Siemens Electrical Works	458	Young & Wildsmith ...	37
		Wandsworth, E.	28
		Imperial Lighting Co. ...	47

Deeds of Assignment.

B. WILSON, wireless engineer, 261, Hornsey Road, N., Ivy Place, Swansea, and 59, East Street, Leicester.—Last day for proofs for dividend, July 31st. Trustee, Mr. G. E. Rolt, 28, Watling Street, E.C.

R. G. CRONYN (Radio Sets and Supplies Co.), 3, King Street, Maidenhead.—Particulars of claims by June 24th, to the Trustees, Mr. W. J. Osborne, Balfour House, Finsbury Pavement, E.C., and Mr. C. Latham, 78, New Oxford Street, W.C.

Recent Contracts.

MESSRS. WORTHINGTON SIMPSON, LTD., have secured a contract for the supply of one 9-in. single-stage high-lift centrifugal pump, capable of delivering 2,000,000 gallons of water per day, against a head of 170 ft., for the Reading Water Works. This pump will run at a speed of 1,500 r.p.m., and will be driven by a 140-b.h.p. Crompton protected type auto-synchronous motor, and is a duplicate of a set previously supplied. These electrically-driven pumps replace the steam pumping plant consisting of a high duty Worthington engine supplied in 1900, and mark the conversion of the Bath Road pumping station into an electrically-driven one. The steam installation is to be retained for stand-by duty.

An important contract covering the main switchgear and a considerable amount of auxiliary apparatus for extensions to the Portobello station of the Edinburgh

Corporation has been placed with the METROPOLITAN-VICKERS ELECTRICAL CO., LTD. The equipment includes a 9-panel extension to the existing main 6,600-V switchgear, a 13-panel, 400-V station service board, and four 15-panel switchboards for the boiler house, together with a 230-V power-station battery and extensions to the station telegraph system. The extension to the main switchgear will include eight 6,600-V metal-clad oil circuit-breakers which, the company states, will be larger than any of this type yet constructed. The circuit-breakers are a development of the "Metro-Vick" "K" type gear, metal-clad and compound-filled, each unit having a rupturing capacity of 1,500,000 kVA. Each circuit-breaker will weigh approximately 11 tons, and each complete unit with its bus-bars, selector switches, and isolating switches, will weigh about 20 tons. A complete system of interlocks is provided to prevent incorrect operation and accident. The circuit-breakers, bus-bar selector switches, and feeder isolating switches, will be electrically operated. By this means the complete control of all switching operations is placed in the hands of one operator.

The METROPOLITAN-VICKERS Co. has also received an order for an electric winder equipment, arranged for double drum operation, for installation at the Choppington Collieries. The winder will be of the a.c. geared type, with a motor of 100-260 h.p., operating at 450 r.p.m. The drive will be transmitted through a double helical reduction gear, giving a speed of 36.55 r.p.m. on two cylindrical drums, each of 7 ft. diameter. One drum will be keyed to the shaft while the other is driven through a clutch, whereby the relative drum positions may be adjusted to allow drawing from different levels without loss of time and output. The maximum depth to be worked is 660 ft., and the winder is to deal with a net load of 1 ton, giving an output of 45 tons per hour. The equipment will include a "Metro-Vick" liquid controller with automatic accelerating gear, and pillar type switchgear with an electrically-operated contactor type reversing switch. A Lilly overwind and overspeed device will be fitted. The mechanical parts are to be supplied by Messrs. John Wood & Sons, Ltd.

Unemployment in Germany.

The Berlin correspondent of *The Times* states that the German unemployment returns for the second half of May show a further decrease in the number of persons in receipt of relief. On June 1st, the number was 649,000, as against 746,000 on May 15th. During the whole of May the number decreased by about 221,000. This does not include the figures for emergency relief, which are published monthly and have of late been in the neighbourhood of 220,000.

Book Notices.

"Four-Place Mathematical Tables with Forced Decimals." By F. S. Carey, M.A., and S. F. Grace, M.Sc. London: Messrs. Longmans, Green & Co., Ltd. Price, 1s. net.—This book contains the usual tables covering the field of practical mathematics, but the tables have been devised to secure greater accuracy in the fourth figure of the values of the functions set out. It is believed that the errors in the values given after interpolation rarely exceed unity. This result is brought about by means of forced decimals and improved devices for interpolation. The forced decimals are indicated by the type in which the decimals and differences are printed, according to whether the approximation given is in excess of the true value or otherwise.

"Miscellaneous Publications of the U.S.A. Bureau of Standards." No. 90, "Directory of Commercial Testing and College Research Laboratories" (15 cents.)

"*Journal* of the Institution of Electrical Engineers." Vol. LXV. July, 1927. London: E. & F. N. Spon, Ltd. Price 10s. 6d.

"Simplified Practice," by C. Chisholm. Pp. xii+151. London: Chapman & Hall, Ltd. Price 12s. 6d. net.

"Repair Shop Diagrams and Connecting Tables for Induction Motors," by D. H. Braymer and A. C. Roe. Pp. xiii+232; figs. 161. McGraw-Hill Publishing Co., Ltd. Price 12s. 6d.

"The Modern Electrical Engineer," by A. Arnold. Four vols., fully illustrated. London: Caxton Publishing Co., Ltd. Price £3 18s. complete.

Social Events.

The Elliott Social Association (Elliott Bros. (London), Ltd.), held its annual sports meeting and garden fête on June 11th. The representatives of the company included Sir Keith and Lady Elphinstone, Mr. W. O. Smith, Mr. and Mrs. L. W. Smith, Mr. and Mrs. A. W. Atkyns, and Mr. and Mrs. R. O. Smith. A very varied programme of sports was successfully carried out and there were numerous side shows. Lady Elphinstone presented the prizes. Music was provided by the Greenwich British Legion Band, and there was dancing until a late hour under the direction of Mr. P. R. Harriss.

The Power Contracts (Batwin) Sports Club, Football Section, held its annual dinner on June 11th, at the Imperial Hotel. After speeches by Messrs. T. H. Windibank, E. H. Bates and R. O. Clark, a very entertaining musical programme was provided.

The fifth annual sports and gala of the Siemens Sports Club took place on Saturday last, at the club's sports ground, Park Lane, Charlton. In spite of the somewhat showery weather, the affair was well attended, and capital sport was witnessed. Much amusement was caused by the humorous items, which included dribbling the football, egg and spoon race, three-legged race, tilting the bucket, cigarette race, &c. Children were specially catered for in the amusement fair in another part of the ground. Credit is due to the organising committee for the way in which the various items were run off without hitch or unpunctuality. The proceedings were enlivened by an excellent programme of music rendered by Callender's Cable Works Band. The prizes were distributed by General Sir H. de la Poer Gough.

The Oil, Chemical and Colour Exhibition.

An International Oil, Chemical and Colour Trades Exhibition was held at the Royal Agricultural Hall, London, N., from June 11th to 18th. There were few exhibits of an electrical nature, apart from motor-operated colour grinders and mixers and kindred machinery. International Combustion, Ltd., extended the scope of the grinding machinery class by showing coal pulverisers, the principal object in the display being a "Raymond" mill. In addition the company showed an example of the "Hum-mer" electrically-operated jigging screen, which is intended mainly for coal. A screen of another pattern, the Sturtevant "Vibro-moto," was exhibited by Messrs. Stevens & Manning. Pulverised fuel equipment was also shown by the Buell Combustion Co., Ltd.; this consisted of two- and three-stage "W.A.C." pulverisers, a "Kek" centrifugal grinding mill, and samples of burners. Oil engines appeared on the stands of Blackstone & Co., Ltd., and Tangyes, Ltd. Among the latter's exhibits was a 19-b.h.p. cold-starting engine driving a generator for the lighting of the stand. Several examples of their rotary air compressors driven by incorporated motors were shown by Messrs. Bernard Holland & Co. The chief exhibit was an 800 cu. ft. per minute set for working at pressures up to 60 lb. per sq. in. Motors formed an integral part of some of the mixers shown by Messrs. Joseph Foster & Sons.

For Sale.

The clerk and steward, Prestwich County Mental Hospital invites offers for surplus generating plant, motors, &c.

Messrs. Fuller, Horsey, Sons & Cassell will sell by auction on July 14th, at the Baltic Exchange, E.C., electrical power plant, &c. (See our advertisement pages to-day.)

Prices of Materials.

In their report on the lead market, Messrs. James Forster and Co. state under date June 18th:—"Little change is apparent in the general position of the metal. Consumers in this country, in view of the renewed decline in prices, are buying as little as possible. On the other hand, arrivals are quite moderate, largely due to the better demand on the Continent, and, apart from warehouse stocks, there is little prompt lead available. . . . As far as the near future is concerned, supplies are likely to be on the short side." Board of Trade returns for May, 1927, indicate:—Imports 21,573 tons, exports 1,446 tons, leaving for home absorption 20,127 tons.

Messrs. F. Smith & Co. report, June 21st: Copper (electrolytic) bars, £60 2s. 6d., 2s. 6d. dec.; ditto ditto sheets, no change; ditto ditto wire rods, £70 2s. 6d., 2s. 6d. dec.; ditto ditto h.c. wire, no change.

Messrs. James & Shakspeare report, June 21st: Copper bars (best selected), sheet and rod, £84, £2 dec.; English pig lead, £25 10s., 10s. dec.

Messrs. Edward Till & Co. report, June 21st: India-rubber. Para fine, 1s. 4½d., 1d. dec.

Lighting and Power Notes.

Arbroath.—STREET LIGHTING.—The Arbroath Electric Light and Power Co., Ltd., has renewed the contract with the Town Council for street lighting at the present charge of £15 10s. per lamp per annum.

Belgian Congo.—ELECTRICAL DEVELOPMENT.—Plans have been drawn up for the establishment of a 10,000-h.p. plant by the Société Minière Kilo-Moto to utilise the water power of the River N'Zoro in the Belgian Congo. The energy generated would be used to operate the dredges used for gathering the gold-containing gravel at the bottom of the River Kibali, and for the treatment of the gold quartz at the Moto mines.

Bethesda (North Wales).—INAUGURATION OF ELECTRICITY SUPPLY.—An electricity supply for the district was commenced recently. The scheme has been carried out by the Pirelli-General Cable Works, Ltd., at a cost of over £7,000. The plant has a capacity of 100 kW, but the maximum load at present is 60 kW. Next winter 148 street lamps will be put into commission. Mr. H. Owen, Bethesda, was the consulting engineer.

Bradford.—INSTITUTION SUPPLY.—The Corporation Health Committee has approved the recommendation by the city electrical engineer (Mr. T. Roles) for the provision of a new high-speed engine and generator, complete with foundations, steam piping, switchgear, &c., at a total estimated cost of £1,650, at the Grassington Sanatorium, and has authorised application for sanction to borrow the necessary sum.

ELECTRICITY EXTENSIONS.—The Corporation Electricity Committee has prepared a scheme for the provision of a sub-

station for the Low Wells district and the laying of distributing mains at a cost of £7,538. The Committee has voted a sum of £20,000 for mains extensions.

Burton-on-Trent.—YEAR'S WORKING.—The accounts of the Corporation electricity undertaking (manager and engineer, Mr. T. Hall) for the year ended March 31st last, record a total income of £102,700, as compared with £94,937 in 1925-26. Owing to the higher cost of coal, working expenses increased from £46,498 to £62,611, leaving a gross profit of £40,089 (£48,439), to which were added rents from Wetmore Road cottages, making a total of £40,337 available. Capital charges, &c., absorbed £35,747, leaving a net surplus of £4,590, of which £2,000 was transferred to the district fund, and the remainder to the renewals fund. The previous year's working resulted in a surplus of £15,153. The capital expenditure during the year amounted to £61,868, bringing the total up to £569,748. The sales of electrical energy increased from 15,628,445 to 15,729,071 kWh, and the average price obtained per kWh from 1.42d. to 1.52d. The energy sold for power purposes fell by 4.16 per cent., but this was counterbalanced by an increase in the cooking and heating supplies of 52 per cent. The maximum supply demand rose from 5,500 to 5,750 kW.

Colne.—YEAR'S WORKING.—The total income of the Corporation Electricity Department during the past year was £39,434, an increase of £4,447. The increase in electricity sold was 249,064 kWh, or 7.85 per cent. The ratio of working costs to net revenue was 64 per cent., solely due to the coal dispute.

Continental.—ITALY.—The Rome correspondent of the *Financial News* reports that the recent loan issued in the New York market by the Società Elettrica dell' Isarco, amounting to $5,000,000, is to be used for the completion of the electric plant at Cardano, on the Isarco river, near Bolzano. The plant is expected to be completed by 1929 and will have an annual output of 500,000,000 kWh.

SWITZERLAND.—What will be the largest hydro-electric undertaking in Switzerland is at present in course of construction by the Oberhasli Kraftwerken Gesellschaft. The scheme provides for the establishment of three plants at Handeck Boden and Innertkirchen to utilise the water power of the Upper Aare river. The preliminary work at the largest plant, that at Handeck, is so far advanced that orders for the electrical machinery have been placed. When complete this station will comprise four vertical-spindle generators, each with a capacity of 28,000-32,000 kVA, supplying at 11,000 V at 500 r.p.m. At present only two are to be installed by the Oerlikon Maschinenfabrik, these being the largest units so far adopted in the country. The weight of the rotors without turbine wheel will, it is stated, be 68 tons, and of the complete generator 165 tons. It is expected that the new alternators will be ready for their tests by May of next year.

Cumberland.—ELECTRICITY SUPPLY.—Application is to be made by the Allerdale Coal Co., of Workington, for an Order to supply electricity to Maryport, Arlecdon, Aspatria, Harrington, Frizington, and other parts of West Cumberland. The company proposes to utilise coke oven gas for the generation of electricity.

Dorchester.—INCREASED CHARGES.—The Corporation Electricity Committee has recommended an increase of charges of ½d. per kWh.

Dundee.—ELECTRICITY SUPPLY.—Mr. D. H. Bishop, Corporation electrical engineer, in a report, explains the city's position under the Central Scotland Electricity Scheme. Irrespective of the existence of the Central Board, Mr. Bishop points out, it would have been, and still is, necessary to add further boilers, auxiliaries, coal handling plant, &c., at Carolina Port in order to meet increasing demands, and to obtain the full output of the present turbo-generating plant. If the Corporation were to be allowed to develop individually, in the absence of the scheme, it would soon be necessary to consider the installation of another large turbo-alternator of about 15,000 kW. The maximum load which could be safely carried on the four small generators at Carolina Port is about 22,000 kW, supposing that the large generator was out of commission. If the rate of increase during the last few years were taken as a guide for the future, this load would be attained in the winter of 1928-29, so a new generator should normally have been ready for the winter of 1929-30. As the scheme does not contemplate connecting up Dundee till 1930-31, it appears that, unless fresh turbine plant is allowed to be installed before then, considerable risks will have to be run.

East Elloe.—ELECTRICITY SUPPLY.—The Rural District Council has given permission to the Boston and District Electric Supply Co., Ltd., to supply electricity throughout its area. The company has agreed to do so subject to the Sutton Bridge and Long Sutton Councils allowing it to supply their districts.

East Ham.—LOAN SANCTIONED.—The Corporation Electricity Committee has received sanction to the borrowing of £9,000 for mains extensions, switchgear, and plant.

East Kent.—INQUIRY.—An inquiry was held at Deal on June 16th by Sir W. F. Marwood relative to the proposal of the South-East Kent Electric Power Co., Ltd., to use overhead lines for the supply of electricity to Deal, Walmer, Sandgate, and Eastry. The company will take a bulk supply from Betteshanger Colliery, and on its behalf it was stated that the route for the overhead cable had been selected to avoid houses, trees, and other obstructions, and to interfere as little as possible with the normal course of agriculture. The cost of the overhead lines (5¼ miles) would be £12,000, and if underground lines had to be used the cost would be increased to £24,000. The principal objections by those concerned near Sandgate were interference with cultivating arable and market garden land by poles, and the alleged inadequacy of the compensation offered.

Glasgow.—REFUSE DISPOSAL PLANT.—The engineer and manager of the Electricity Department, in a report to the Corporation Cleansing Committee, states that in connection with the generator house at the new refuse disposal works he has noted that no special provision appears to have been made regarding a 3-phase, 440-V, 50-period supply to the charging plant to be installed in the garage to be attached to the new works; that the two 500-kVA transformers at present arranged for and intended for the operation of the various motors used throughout the works would no doubt be able to supply the 300 kW required for charging purposes, but that this would leave a somewhat inadequate margin for emergency. In order that adequate provision may be made to meet the garage requirements, he suggests that either two 750-kVA transformers be substituted for the two 500-kVA transformers provided for by the contract, at an estimated additional cost of £600, or that one additional 500-kVA transformer, with switchboard, &c., be installed, at a cost of £1,000. The special sub-committee, having had submitted to it a letter from Messrs. Heenan & Froude, Ltd., stating that the two 500-kVA transformers have now been completed and cannot be altered, has agreed to recommend that no alteration be made in the existing arrangement.

Hastings.—LOAN.—The Town Council has applied for sanction to a loan of £53,389 for additional plant at the Broomgrove power station, *viz.*: Turbo-alternator, £22,675; boiler and economiser, £14,000; cooling tower tank, £2,550; two cooling towers, £3,190; pipe work, £5,962; instruments and sundries, £550; cables, £1,620; contingencies, £2,542.

Huntly (Aberdeenshire).—ELECTRICITY SCHEME.—The Town Council is considering a scheme for the introduction of electricity into the burgh. The maximum h.p. available will be 250, and the estimated cost is between £16,000 and £17,000.

Inverness.—ELECTRICITY SUPPLY.—In reply to critics of the Town Council's action in taking over the electricity undertaking at a cost of £80,000, Provost MacEwen at the last meeting stated although the accounts had not been adjusted he understood that the gross profit on the undertaking for the period of ten months was over £12,000. The net profit, after charging interest and sinking fund, was over £7,000.

SUPPLY TO RAILWAY COMPANY.—A request from the L.M.S. Railway Company for a reduction in the rate for the electricity supplied was considered. The company pointed out that the rate of 3d. per kWh which it was charged for power was higher than anywhere else, and that if the Council could meet the company in the matter, it would be prepared to install new plant at its works at Inverness and would probably use an additional average consumption of 100,000 kWh per annum. It was agreed that the company be offered a rate of 1½d. per kWh.

Japan.—ELECTRICAL DEVELOPMENTS.—It is understood that the Tokyo Dento K.K. has decided to extend its Senju power station to a capacity of 75,000 kW by the end of 1928.

The Korean Hydro-Electric Co. has decided to buy generators from the Siemens and water turbines from the Voigt companies for its first power station. The water turbines will be of 32,000 kW.

It is reported that the railway authorities have decided to commence the construction of the Shinano-Gawa hydro-electric power stations this fiscal year, for which land will be purchased and a light railway will be built.

London.—ISLINGTON.—The Electricity Committee has received sanction to borrow £72,000 to cover expenditure incurred and estimated to be incurred in respect of distributing works during the period from April, 1926, to March, 1929.

Lowestoft.—ELECTRICITY IN BULK.—At a recent meeting of the Corporation Electricity Committee, the Town Clerk submitted a report of an interview with the Electricity Commissioners on the question of the draft agreement for the bulk supply of electricity by the Great Yarmouth Corporation to the Lowestoft Corporation. Lowestoft's contention that the agreement should place upon the Yarmouth Corporation the obligation to provide any plant necessary to enable it to meet future requirements was upheld by the Commissioners. They had been unable to agree upon the terms of the clause providing for a sliding scale in the "unit" charge for electricity based upon the cost of coal to the Yarmouth Corporation. Lowestoft also submitted that the minimum annual payment of £12,000 was excessive, and it was agreed that for the first full year of operation the minimum charge should be £9,490, £11,000 for the second year, and that the minimum charge of £12,000 should be made after that period. The Yarmouth Corporation objected to a penalty clause which Lowestoft had inserted in the draft agreement, but the Commissioners agreed that Lowestoft was entitled to have such a clause. Yarmouth also took exception to the insertion in the agreement of a

clause removing all possible doubt as to whether Lowestoft should be entitled as authorised undertakers to demand or take a supply of electricity from the Central Electricity Board under the terms of the Electricity (Supply) Act, 1926, if and when such supply became available. On this point the Commissioners will settle a clause for insertion in the agreement. The Commissioners reserved their decision regarding other minor points. The Electricity Committee has reported that as it will not be possible to procure a bulk supply of electricity from Yarmouth during the coming winter months, arrangements have been made with Messrs. John Chambers, Ltd., for the use of the firm's generating station at Oulton Broad in order to augment the output from the Council's electricity works. The Committee is entering into an agreement with them for the use of this plant from September 30th, 1927, to April 30th, 1928, and for such further period as it may be required in consideration of payment of £300 per annum.

Lymington.—ELECTRICITY CHARGES.—In reply to a communication from the Electricity Commissioners, the Rural District Council has decided to acquiesce in an application of the Town Council for an Order reducing the price of electricity from 1s. to 10d. per kWh as from June 30th next. The Lymington Electric Light & Power Co., Ltd., has intimated that it will not oppose such an Order.

Manchester.—NEW PLANT.—The Corporation Electricity Committee has voted the following estimates:—Generating stations, land, buildings, machinery, &c., £308,400; distributing stations, transforming stations, and High Street stores, land, buildings, machinery, &c., £44,600; mains and services, £349,000; motors, cookers, and meters, £44,000; street lighting, £6,000.

Northern Ireland.—LISBURN (CO. ANTRIM).—From a statement made at a recent meeting of the Urban District Council it would appear that the proposed scheme by a private company to supply the town with electricity is being held up, owing to the Electricity Commissioners objecting to the clauses giving the Council the right to acquire the undertaking at any time after the end of ten years, and compelling the company to pay to the Council a "royalty" of ¼d. on every kWh sold within the district at a price exceeding 2¼d. The Commissioners are not prepared to approve the agreement until both clauses are excluded.

Oxford.—PROPOSED PURCHASE OF UNDERTAKING.—The Town Council has decided to obtain counsel's advice as to the legal position in respect of the purchase of the undertaking of the Oxford Electric Co., Ltd.

Paisley.—ELECTRICITY SUPPLY.—The Town Council has decided to undertake the wiring and lighting of the common stairs, passages and private courts in all suitable properties by electricity at a charge of £1 per lamp per annum. The public lighting of the whole town is now provided entirely by electricity, special distributing cables having been laid in every street. It is intended to lay a service cable from the street lighting cables to each block of tenement houses and to feed the common stair lights for the whole block from one service. All the stair lights as well as the street lighting will thus be controlled at the power station. It is expected that the scheme will be completed within two years.

Price Reductions.—Reductions in the charges for electricity have been made or recommended in the following districts:—

RICHMOND (SURREY).—Reductions ranging from ¼d. per kWh in the case of small consumers.

BEDWORTH.—Lighting: From 7d. to 6d. per kWh.

Shipley.—INAUGURATION OF NEW PLANT.—The inauguration ceremony in connection with the change over from local generation to a 33,000-V supply from the Yorkshire Electric Power Co., which takes place at the Council's electricity works on June 30th, will be performed by Sir Andrew Duncan, chairman of the Central Electricity Board, in the presence of a gathering including representatives of all the principal electricity undertakings of West Yorkshire. Shipley is the first town in this area to effect this change over.

Special Orders.—Applications have been made to the Electricity Commissioners for Special Orders by the Urban District Council of New Hunstanton, authorising it to supply in the urban district and the parish of Hunstanton, Mr. F. H. Grace to supply in the parishes of Thornbury, Olveston, and Alveston, and the Lichfield Corporation to supply in certain parishes in the rural district of Lichfield.

The Cannock Chase Colliery Co., Ltd., has applied for an Order to make provision for the transfer to the company of the undertaking authorised by the Chasetown and District Electricity Special Order, 1924.

Swansea.—ELECTRICITY EXTENSIONS.—The Corporation Electricity Committee has considered a comprehensive mains scheme prepared by the borough electrical engineer for the St. Thomas area, and has instructed him to carry it out at a cost of about £11,500.

The Committee has also instructed the electrical engineer to carry out the necessary works in connection with the laying of the following e.h.p. mains, &c.: E.h.p. main, &c., from Winch Wen sub-station to Llansamlet colliery (£4,357); e.h.p. loop into Maesteg sub-station from G.W. Railway, one main for alternate feed to Maesteg or G.W. Railway (£475); disconnecting tee pillar at Wychtree Bridge for junction of Morriston, Llansamlet, copper pit brickworks, &c. (£250).

Uttoxeter.—ELECTRICITY SCHEME.—The report of Mr. W. C. C. Hawtayne, of London, who was consulted by the Urban District Council with reference to the provision of an electricity supply for the town, has been received. The Council has decided to apply for an Order authorising it to develop a scheme and lay distributing mains throughout the town. A supply of electricity in bulk will be obtained from Burton-on-Trent. The estimated cost of the scheme is £16,650 for the first year, rising to £22,500 in the third year, and it is anticipated that a supply will be available in about a year's time.

Watford.—LOANS.—The Corporation Electricity Committee has received sanction to a loan of £50,000 for mains and services.

Application is to be made for sanction to the borrowing of £2,000 for mains and sub-station kiosks in connection with the supply of electricity to Bourne End, and £1,000 for public lighting at Garston.

Tramway and Railway Notes.

Bradford.—LOANS SANCTIONED.—The Ministry of Transport has sanctioned the borrowing by the City Council of £2,500 for purposes of the railless trolley vehicle undertaking in respect of the cost of additional overhead equipment for a through service between Oakenshaw and the centre of Bradford. Sanction has also been received to the borrowing of a sum not exceeding £17,020 for the provision of 12 motor-omnibuses for the Tramway Department.

Colne.—YEAR'S WORKING.—The revenue from the Corporation tramway undertaking during the past year was £23,971, a decrease of £818, due to the replacement of the Laneshaw-bridge cars by motor-omnibuses, and to loss of revenue during the general strike. The receipts per car-mile were 23.09d., an increase of 1.5d.

Continental.—POLAND.—A special commission appointed by the Polish Minister of Communications has inspected the construction work on the Warsaw-Grodzisk suburban electric railway line. The line will probably be ready for use towards the end of September; it will greatly relieve the Warsaw-Vienna line and improve direct communications.—*Reuter's Trade Service* (Warsaw).

Huddersfield.—NEW DEPOT.—The Tramways Committee has recommended the erection of a large new depôt for the department's motor-'buses to hold 64 vehicles.

India.—RAILWAY ELECTRIFICATION.—A comprehensive scheme for the electrification of the suburban service on the Eastern Bengal Railway has been drawn up and submitted to the Railway Board. The details of the scheme are not yet available. After the approval of the Railway Board, the scheme will have to be approved and sanctioned by the Secretary of State and thereafter be placed before the Railway Finance Committee of the Legislative Assembly and ultimately before the Indian Legislature.

The North-Western Railway's programme for electrifying its stations is making rapid progress. The work at Ferozepore and Multan will be completed within the next two months. At Peshawar and Bhatinda, work on the generating plant will be started soon, while estimates have been sanctioned for the electrification of Lyallpur, Sukkur, and Rohri.

Liverpool.—OVERHEAD RAILWAY.—The Liverpool Overhead Railway Co. changed over to the Corporation power supply on June 19th and closed down its own generating station. Electricity is being supplied at 520 V d.c. from three of the Corporation's sub-stations.

London.—PROPOSED NEW ROUTE.—The *Daily Telegraph* reports that a proposal by the L.C.C. to construct a new tramway route to the Crystal Palace—which originated as far back as 1898 when a company proposed to build a light railway—has reached another stage. The Camberwell Borough Council has been asked by the Finance Committee to veto the L.C.C.'s proposal. The L.C.C. asked whether, in the event of its deciding to seek Parliamentary powers in respect of the construction of tramways from West Norwood to the Palace, the Borough Council would be prepared to consent to any of certain alternative routes being used. Six points are tabulated by the Camberwell Finance Committee against the scheme. These include the suggestion that there is no necessity for a tramway route inasmuch as better methods are now available, and it is questionable whether the route would be remunerative. The addition of tramways, it states, would add to the congestion of the roads, and the proposed route is also unsatisfactory.

Telegraph and Telephone Notes.

Argentina.—POST OFFICE AND TELEGRAPHY.—The primary object of the Executive Power during the past year has been to obtain the perfect operation of the Postal and Telegraph services. This important public service has been carried on regularly notwithstanding its extraordinary growth and the shortage of *personnel*, each day more apparent. On July 12th last was inaugurated the Library and Museum of Posts and Telegraphs, as also the Philatelic Section as a part of the same. An arrangement made with the Union Telephone Company, in the Federal Capital, and the Telephone Company in Tucumán, has enabled the Executive Power to endow both localities with the service known as "telephonegrams." During the year 1926 there was a great increase in the movement of internal postal and telegraphic drafts amounting to 2,176,499 items for a total of $78,601,612.63 m/n. and in that of telegraphic orders 137,944 items for a sum of $9,026,132.43 m/n. The total of declared values received was 413,844 items for a sum of $57,958,382.06 m/n., the dispatches being 472,193 for $64,974,290.49 m/n. The telegraph lines on December 31st last amounted to 44,248 kilometres in extent and to 114,318 kilometres of development.—*Financial Times.*

Sweden.—LONG-DISTANCE TELEPHONE.—Telephone communication between Stockholm and Paris was opened on June 16th and worked excellently. There were only eleven conversations.—*Reuter's Trade Service* (Stockholm).

A preliminary service was also made available between Stockholm and London on June 22nd daily from 3 p.m. to 8 a.m., with a reduced call fee at night.

The Telephone Service.—NEW EXCHANGES.—New central battery exchanges at Dudley Hill and Low Moor are to be followed shortly by one at Idle, where the site has been secured at The Grove.

The new automatic telephone exchange at Halifax was inaugurated on June 18th, the change-over from the old exchange being made at 2 p.m.

United States.—TELEPHONE DEVELOPMENT.—The *Daily Telegraph* reports that of the total number of telephones in the United States nearly two-thirds, or, in round figures, 11,400,000, are in domestic use, and serve about 10,700,000 families. In England, where approximately 1,500,000 telephones are in use, only one-third, or 500,000, are "family 'phones."

Radio Notes.

Australia.—PROPOSED NEW STATIONS.—Some time ago a sub-committee was appointed by the New South Wales Cabinet to inquire into a proposal for the erection of a Government super-power wireless station near Sydney and six relay broadcasting stations in country areas. It is said that the sub-committee's report is favourable to the scheme, which is receiving Cabinet consideration.—*Reuter's Trade Service* (Sydney).

Greece.—NEW MARKET.—His Majesty's Consul-General at Salonica (Mr. F. E. Crow) reports that the Wireless Telegraphy Board in Athens has decided to allow the use of radio-receiving sets in Salonica and Cavalla. The necessary licences for the installation of receivers must be obtained from the Wireless Department of the Post Office in Athens. For the time being permission will only be granted to Greek subjects, but it is thought that the privilege will shortly be extended also to foreigners. Macedonia is a virgin market for the sale of wireless apparatus. British manufacturers wishing to do business there should therefore communicate at once with local dealers and agents, quoting prices and sending illustrated catalogues in French, if possible, as well as English. The names of the principal dealers in electrical goods, also those of small dealers in wireless apparatus, can be furnished on application to the Department of Overseas Trade.

South Africa.—SINGLE MANAGEMENT—The recently-formed South African Broadcasting Co., after having taken over and resuscitated the Johannesburg station, has since also purchased the Cape Town station and entered into an agreement with the Durban Town Council to take over its station, which is unique in South Africa in being owned by the municipality, and the transfer takes place on July 1st next. With all the South African broadcasting stations now under one management, it is intended to interconnect them all with land lines and take full advantage of relaying, and it is hoped, by establishing further relay stations, to enable the small crystal user to benefit in various parts of the country. The new company, being also interested in the African Theatres Trust, intends to transmit items from various theatres with greater variety of artistes than there is under present arrangements.

United States.—EXPORTS.—The United States Trade Commissioner at Ottawa has reported to the Dominion Bureau of Statistics that the exports to Canada of radio sets and parts from the United States during the calendar year 1926 amounted in value to £2,872,991, and included the following items: 32,768 receiving sets, worth £1,238,680; 96,059 valves, valued at £113,837; and £1,520,474 worth of parts and accessories.

Contract Information.

When "Contracts Open" are advertised in our "Official Notice" pages, the date of the ELECTRICAL REVIEW containing the advertisement is given in parentheses below.

Contracts Open.

Australia.—MELBOURNE.—August 15th. Postmaster-General's Department. One 55-ton 3-motor-type electrically-operated overhead travelling crane. (A.X. 4727.)*

August 16th. Automatic telephone exchange equipment. (B.X. 3566.)

November 14th. State Electricity Commission of Victoria. Two 10,000-kW back-pressure turbo-generators and accessory plant.

SYDNEY.—July 18th. Municipal Council. Boiler-house equipment for the Bunnerong power station. (B.X. 3531.)*

August 15th. Generator neutral earthing resistance. (B.X. 3550.)*

Cheadle and Gatley.—June 28th. Electricity Department. Static transformer, e.h.p. switch cubicle, and transformer switch and distributor kiosk. (June 10th.)

East Ham.—June 29th. Education Committee. Wiring at Mondega Road School. Secretary, Mr. F. R. Thompson, Education Offices, Town Hall, East Ham, E.6.

Edinburgh.—June 25th. Education Authority. Electric light and power installation at Bellevue Technical and Commercial School. Schedules, Mr. J. A. Carfrae, architect, 3, Queen Street, Edinburgh.

Flint and Hope.—July 5th. Flintshire E.C. Electric light installation at schools. Mr. R. G. Whitley, county architect, Mold.

Harrogate. — June 27th. Electricity Department. Transformers, meters, house-service fuse boxes. (June 17th.)

Halifax.—June 25th. T.C. Wiring 118 houses, Albert Road, for electric light; borough engineer. (Returnable deposit of £2 2s.)

Hazel Grove and Bramhall.—June 28th. Urban District Council. 2,800 yd. .06 3-phase, 6,600-V cables, including laying and accessories. (June 17th.)

Huddersfield.—July 4th. Education Committee. Electric light installation, Almondbury, Berry Brow, Crosland Moor and Paddock schools. Borough architect, 26, Ramsden Street.

India.—SIMLA.—July 25th. India Stores Department. Electrical cooking appliances for the Government House, New Delhi. (B.X. 3575.)

Kirkcaldy.—July 2nd. Electricity Department. L.p. a.c. distribution, l.p. and e.h.p. cables, boxes, and roadwork. (June 10th.)

Leamington Spa.—July 1st. Town Council. Five centrifugal pumps, with five electric motors, suction and delivery piping, valves, automatic control gear, &c. Particulars from Mr. S. C. Eagles, civil engineer, 71, Temple Row, Birmingham.

London.—STEPNEY.—July 11th. Electricity Supply Department. Boilers and boiler-house accessories, turbo-alternator, condenser, accessories, and switchgear. (June 3rd.)

LEWISHAM.—July 4th. Board of Guardians. Steam and electric steriliser plant, for the operating theatre. Mr. G. W. Martin, consulting engineer, 33, Arran Road, Catford, S.E.

Lurgan.—June 30th. Electric lighting plant, pump, &c., for the Maralin rectory and church. Specifications from Mr. C. Nicholson, secretary, Maralin, Lurgan.—*Irish Electrician.*

Newcastle-under-Lyme.—July 11th. Electricity Supply Department. 350-kW rotary convertor, with e.h.p. and l.p. switchgear. (See this issue.)

New Zealand.—WELLINGTON.—August 9th. Public Works Department. 1,500 suspension insulator strings and 470 strain insulator strings. (B.X. 3533.)*

August 18th. Corporation Tramways. One electrically-operated tramcar traverser. (A.X. 4801.)

September 13th. Two sets 110-kV outdoor switchgear for the Waikato electric power scheme. (B.X. 3579.)

October 4th. Batteries and charging sets for Mangahao electric power scheme. (B.X. 3580.)

Plymouth.—July 6th. Mental Hospital Visiting Committee. 50-h.p. oil engine electric generating set for the mental hospital, Blackadon. Town clerk, Municipal Buildings.

Pudsey.—June 28th. Electrical installations for 96 houses, Smithroyd Park. Specifications, &c., from Mr. B. H. Noble, borough surveyor, Town Hall.

Shitlington, West Riding.—July 19th. West Riding Education Committee. Electrical installation for the Middlestown new school. Specifications, &c., from Education Department, County Hall, Wakefield.

Singapore.—July 25th. Municipal Commissioners. One 10,000-kW turbo-alternator and condensing plant. (See this issue.)

Smethwick.—June 25th. Smethwick and Oldbury Joint Hospital Committee. Electric lighting installation at the Holly Lane Hospital. Mr. F. Chapman, clerk.

South Africa.—CAPE TOWN.—June 30th. South African Railways and Harbours Board. Gasfilled and vacuum lamps for 12 months. (B.X. 3518.)* Telegraph material. (B.X. 3519.)*

PIETERMARITZBURG.—July 13th. City Council. Single- and 3-phase electric motors and starting switches for 12 months.—City Electrical Engineer. *South African Mining and Engineering Journal.*

Southend-on-Sea.—July 6th. Light Railways and Electricity Department. L.p. and e.h.p. cables for 12 months. (June 3rd.)

July 5th. 3,000 meter boards. (June 17th.)

Whitehaven.—July 1st. Rural District Council. Installing two miles of overhead cable and erection of fittings, &c., in connection with the electric lighting of streets at Moresby Park Village. Mr. W. J. Goode, engineer and surveyor, Union Hall, Whitehaven.

* Further particulars can be obtained at the Department of Overseas Trade (Inquiry Room), 35, Old Queen Street, S.W.1.

Contracts Closed.

Basingstoke.—Town Council. Accepted:—

Wiring 126 houses for electric light at £639.—T. M. Kingdon & Co. (Thirty-nine tenders were received, the highest being £2,400.)

Birmingham.—Board of Guardians. Accepted:—

Wiring contract for the Western Road Institution (£115).—T. Glover.

Bradford. — Health Committee. Grassington Sanatorium :—

One 75-kW high-speed engine (£396).—Belliss & Morcom, Ltd.

One 75-kW direct-coupled generator (£329).—English Electric Co., Ltd.

Overhauling and repairing horizontal engine (£120).—Newton, Bean & Mitchell.

Tramways Committee.

100 steel tramcar tires for D.K. trucks (£235).—Vickers, Ltd.

Government Contracts.—The following contracts were placed by various Government departments during May, 1927 :—

ADMIRALTY CONTRACT AND PURCHASE DEPARTMENT.

Electric cable.—British Insulated Cables, Ltd.; Edison Swan Cables, Ltd.; General Electric Co., Ltd.; Siemens Bros. & Co., Ltd.; Enfield Cable Works, Ltd.

Electric hot cupboards.—Benham & Sons, Ltd.

E.h.p. cables.—W. T. Henley's Telegraph Works Co., Ltd.

Aluminium alloy lamp fittings.—General Electric Co., Ltd.; W. McGeoch & Co., Ltd.; Engineering and Lighting Equipment Co., Ltd.; J. Beresford & Sons, Ltd.

Motor reducer set.—Laurence, Scott & Co., Ltd.

Electric bakery plant.—Carron Company.

Motor-driven pumps.—J. Stone & Co., Ltd.

Switch and sockets.—General Electric Co., Ltd.

W/T valves.—Mullard Radio Valve Co., Ltd.

WAR OFFICE.

Overhead travelling electric crane.—Royce, Ltd.

X-ray sets.—Solus Electrical Co.

AIR MINISTRY.

Accumulators.—C. A. Vandervell & Co., Ltd.

Amplifier.—Gambrell Bros., Ltd.

Battery charging panels (various stations).—Harland Engineering Co., Ltd.

Motor-generator sets (various stations).—General Electric Co., Ltd.

Stand-by generating sets (Kenley and Suttons Farm).—Aster Engineering Co. (1913), Ltd.

Underground cables (Upper Heyford).—Malcolm & Allen, Ltd.

W/T transmitting station (Mitcham).—Pearce Bros.

Delco ignition spares.—Delco-Remy & Hyatt, Ltd.

Receivers.—H. W. Sullivan, Ltd.

Telephone and headbands receivers.—Standard Telephones and Cables, Ltd.

Transmitting and receiving sets.—Marconi Wireless Telegraph Co., Ltd.

POST OFFICE.

Telephone apparatus.—Ericsson Telephones, Ltd.; International Electric Co., Ltd.; Siemens Bros. & Co., Ltd.; Standard Telephones & Cables, Ltd.

Testing, protective and miscellaneous apparatus.—Phœnix Telephone & Electric Works, Ltd.

Battery stores.—Hart Accumulator Co., Ltd.

Terminal blocks.—T. De la Rue & Co., Ltd.

Battery boxes.—Siemens Bros. & Co., Ltd.

Cable (various).—British Insulated Cables, Ltd.; Connollys (Blackley), Ltd.; Enfield Cable Works, Ltd.; W. T. Glover & Co., Ltd.; Hackbridge Cable Co., Ltd.; W. T. Henley's Telegraph Works Co., Ltd.; Johnson and Phillips, Ltd.; Pirelli-General Cable Works, Ltd.; Siemens Bros. & Co., Ltd.; Standard Telephones and Cables, Ltd.; Union Cable Co., Ltd.

Casing and cover.—W. Duncan Tucker & Sons, Ltd.

Joint box castings.—United Steel Co., Ltd. (T. Butlin and Co. Branch).

Cords for telephones.—London Electric Wire Co. & Smiths, Ltd.

Ironwork.—Bullers, Ltd.

Mouthpieces.—North British Rubber Co., Ltd.

Distribution cable plugs.—Siemens Bros. & Co., Ltd.

Wire.—W. T. Henley's Telegraph Works Co., Ltd.

New lift and extension to existing lift, Post Office Stores Department.—W. Wadsworth & Sons, Ltd.

Radio station switchgear and cabling (Portishead).—Drake and Gorham, Ltd.

Valve transmitter (Humber).—Radio Communication Co., Ltd.

Telephone Exchange equipment.—Lofthouse Gate (Wakefield Multi Office Area): Siemens Bros. & Co., Ltd. Sub-contractors: Small Electric Motors, Ltd., for ringing machines. Goole (Yorks): Siemens Bros. & Co., Ltd. Sub-contractors: Hart Accumulator Co., Ltd., for batteries; Crompton & Co., Ltd., for ringing machines; English Electric Co., Ltd., for charging machines. Harpenden (Herts): Siemens Bros. & Co., Ltd. Sutton (Surrey): General Electric Co., Ltd. Sub-contractors: Chloride Electrical Storage Co., Ltd., for batteries; Crompton & Co., Ltd., for machines. Archway (N.): General Electric Co., Ltd. Sub-contractors: D.P. Battery Co., Ltd., for batteries; Crompton & Co., Ltd., for machines. Wilmslow (Cheshire): General Electric Co., Ltd. Maryland (E.) and African and Eastern Trade Corporation, Ltd. (Liverpool): Standard Telephones and Cables, Ltd. Chapeltown (Leeds) and Shrewsbury: Automatic Telephone Mfg. Co., Ltd. Cobham (Surrey): Ericsson Telephones, Ltd. Liverpool Warehousing Co., Ltd. (Liverpool), G. Salter and Co., Ltd. (West Bromwich), Shell-Mex, Ltd. (W.C.), Accles & Pollock, Ltd. (Oldbury): Relay Automatic Telephone Co., Ltd.

CROWN AGENTS FOR THE COLONIES.

Cables.—W. T. Henley's Telegraph Works Co., Ltd.

Generators.—Electric Construction Co., Ltd.; J. Stirk and Sons, Ltd.

Insulators.—Taylor, Tunnicliff & Co., Ltd.

Switchgear.—British Thomson-Houston Co., Ltd.

Telephones: Standard Telephones and Cables, Ltd.

Train lighting equipment.—Chloride Electrical Storage Co., Ltd.; J. Stone & Co., Ltd.

Transformers.—British Electric Transformer Co., Ltd.; Brush Electrical Engineering Co., Ltd.

Irish Free State.—Controller of Stores (Posts and Telegraphs).

Broadcasting apparatus.—British Thomson-Houston Co., Ltd.; General Electric Co., Ltd.

Cable (various).—Routledge & Co.

Cable drums.—Siemens Bros. & Co., Ltd.; McMillan and Co.

Jacks (telephone).—Phœnix Telephone and Electric Works, Ltd.

Platinum contacts.—Marconi (Ireland), Ltd.

Radiators.—British Thomson-Houston Co., Ltd.

Receivers (for telephones).—Ericsson Telephones, Ltd.

Relays (for telegraphs and telephones).—Standard Telephones and Cables, Ltd.

Sets (for telegraphs and telephones).—Hart Accumulator Co., Ltd.
Switches.—Walters Electrical Manufacturing Co., Ltd.
Thermographs.—Cambridge Instrument Co., Ltd.
Transmitters.—Phœnix Telephone and Electric Works, Ltd.
Wireless telephone installations.—Marconi (Ireland), Ltd.
—*Irish Electrician.*

Llanfairfechan.—Urban District Council. Accepted:—
Mains (cables).—British Insulated Cables, Ltd.
Trenching and cable laying.—Durnford Construction Co., Ltd.
Transformers and switchgear.—English Electric Co., Ltd.

London. — SHOREDITCH.—Lighting Committee. Recommended:—
Ventilating equipment at Evelyn sub-station (£460).—Davidson & Co., Ltd.
Ash-handling and storage plant at the Whiston Street generating station (£1,055).—Fraser & Chalmers Engineering Works.
New feed water mains in connection with the boiler extension at Whiston Street (£700).—Babcock and Wilcox, Ltd.
Air filter at Coronet Street sub-station (£180).—Davidson and Co., Ltd.
L.p. cable (£1,172).—W. T. Glover & Co., Ltd.

HAMMERSMITH.—Electricity Committee. Recommended:—
Three 250-kW, eight 200-kW, and three 50-kW air-cooled transformers (£3,044).—British Electric Transformer Co., Ltd.
E.h.p. ironclad switchgear (£793).—Metropolitan-Vickers Electrical Co., Ltd.
60 h.p. switches (£917) and twelve 10,000-amp. circuit breakers (£107).—J. G. Statter & Co.
Three 6-way and two 4-way l.p. fuse units (£108).—Lucy and Co., Ltd.
11,000-V, 6-core cable (£2,147).—Hackbridge Cable Co., Ltd.
Repair and overhaul of single-phase switchboard (£121).—Switchgear & Cowans, Ltd.

Manchester.—Tramways Department. Accepted:—
Fifty type W.T. 31K. motors (50 h.p. rating).—General Electric Co., Ltd.

South Africa.—DURBAN.—Municipal Council. Accepted:—
Cables and switchgear in connection with the linking-up the Congella power station and the municipal power station:—
Cables (£25,172).—British Insulated Cables, Ltd.
Switchgear (Congella) (£5,864); ditto, municipal power station (£1,592).—A. Reyrolle & Co., Ltd.
Regulators and reactances (Congella) (£3,008); reactors (municipal power station) (£617).—Metropolitan-Vickers Electrical Co., Ltd.

JOHANNESBURG.—Municipal Council. Accepted:—
1,000 primary fuses and plugs (£317).—South African General Electric Co., Ltd.
3 miles h.d. trolley wire (£288).—British General Electric Co., Ltd.
24 6,600/110-V, single-phase potential transformers (£200). A.E.G. Engineering Co. (S.A. Proprietary), Ltd.
One mile h.p. cable (£1,031).—W. T. Henley's Telegraph Works Co., Ltd.
—*S.A. Mining and Engineering Journal.*

Stretford.—Health Committee. Accepted:—
Electrolysing plant at Empress Street depôt (£118).—Mather & Platt, Ltd.

Electricity Committee. Accepted:—
Electric lamp columns (56s. 3d. each).—R. A. Bradshaw and Son.

Wakefield.—Housing Committee. Accepted:—
Wiring 200 houses on the Snapethorpe estate.—J. E. Fowler.

Woodford.—Urban District Council. Accepted:—
Installation of internal telephone system at Council offices, and maintenance.—Commercial Telephone & Electrical Co.

Forthcoming Events.

Electrical Contractors' Association.—June 22nd to 25th. Scarborough Annual Conference.

Physical Society.—Friday, June 24th. Imperial College of Science, S. Kensington, S.W. 5 p.m. Ordinary meeting.

Institution of Mining Engineers.—June 29th to July 1st. Newcastle-upon-Tyne. General meeting.

Tramways and Light Railways Association.—June 29th to July 1st. Bath. Annual Congress.

Institution of Electrical Engineers (South-Midland Centre).—Thursday, June 30th. Visit to Dolgarrog.

The "Electrical Review" Service Department.

INQUIRIES must be accompanied by a stamped addressed envelope.

We should be glad to learn the names and addresses of makers of the following:—

DAYKOL daylight fittings.
TELLUS vacuum cleaners.

Readers occasionally desire to be put in touch with companies undertaking to finance hire-purchase schemes for domestic apparatus, such as vacuum cleaners, cookers, &c. We should be glad to learn the name of any reliable concern of this nature.

Notes.

Electrical Questions at the League of Nations.

Mr. D. N. Dunlop has been appointed the British representative on the Permanent Committee on Electrical Questions set up by the Advisory and Technical Committee for Communications and Transit of the League of Nations. The agenda for the meeting held in November, 1926, included the three following matters:—

(*a*) The ratification of the conventions adopted in 1923 relating to the transmission in transit of electric power, and to the development of hydraulic power.

(*b*) The establishment of an international centre of information.

(*c*) The relations of the Committee with other international organisations dealing with electric questions.

Mr. Dunlop, in addition to being director of B.E.A.M.A., is chairman of the International Executive Council, World Power Conference, and of the British National Committee.

The Use of Photo-Electric Cells in Photometry.

Amongst the papers read at the meeting of the Optical Society on June 9th was one by Mr. T. H. Harrison, Ph.D., B.Sc., who gave a description of apparatus and experiments designed for obtaining the highest accuracy and precision in the photometry of electric lamps, using photo-electric cells. Although the methods adopted were not novel, every care had been taken to obtain the highest sensitivity in the photo-electric current measuring apparatus and to maintain the lamps at a steady accurately-known voltage. It was claimed, therefore, that the results were useful in showing the maximum capabilities of photo-electric cells when used in the usual manner with a sensitive electrometer or electroscope. The actual results obtained were tabulated, and an examination was made of the sources of error to be expected, of the method by which they might be avoided, and of the computation of the accuracy of the results.

The I.E.E. Wiring Regulations.

We have received from the Institution of Electrical Engineers a copy of the 9th edition (May, 1927) of the "Regulations for the Electrical Equipment of Buildings," which is published by Messrs. E. & F. N. Spon, Ltd., price 1s. 6d. (cloth), or 1s. (paper), plus postage 2d. Copies can also be obtained from the Institution.

A footnote states that this edition contains a number of alterations which had become urgent, but does not differ considerably from the eighth edition. It appears that the alterations and additions approved by the Council on July 16th, 1925, and issued in the form of a pamphlet have been incorporated in the text of the 9th edition, but a comparison of the two books indicates that there are many minor additions and omissions, transpositions, &c., which render the task of identifying the changes very laborious. For instance, the old Regulation 64, "Main Switchgear," has in modified form been included under the more appropriate heading, "Control of Supply," Regulation 94, in the new issue. The total number of clauses remains at 128, and of the tables at xiv. Appreciable alterations have been made in Tables IV, vulcanised rubber cables; V, impregnated-paper and lead-covered cables; VI, flexible cables for use with portable appliances; and VIII, flexible cords. These changes are mainly in the current-carrying capacity; in some cases the amperage has been increased by 40 or 50 per cent. (flexible cords), or 30 per cent. (flexible cables for portable appliances) throughout, but in others the changes are partly one way and partly the other.

The Wiring Regulations Committee has in preparation a Tenth Edition, which, with a view to simplification, may differ materially from the Ninth in respect of arrangement and wording.

The Extra-High-Pressure Conference at Paris.

The headquarters of the British members attending the above conference will be the Hotel Campbell, 47, Avenue de Friedland. This hotel is quite near the Salle Hoche, where the conference will take place, and will form a very convenient place of meeting for those attending the conference, even if they do not happen to stay at the hotel.

Centenary Lecture.

In a lecture recently given by Dr. J. A. Fleming in connection with the centenary celebrations of University College, University of London, he referred to the strides which had taken place in the work of electrical communication and to the contributions made by men like Alexander Graham Bell. Although the practical applications of electricity had largely come from America, the fundamental ideas were to a great extent due to British scientists. Dr. Fleming said it was the electrical engineer who met those imperative needs which the pressure of population on the means of existence brought about.

The I.M.E.A. Exhibition.

In addition to the exhibits referred to in our last three issues at the exhibition of apparatus held in connection with the Convention of the Incorporated Municipal Electrical Association at Buxton, some items which should not be passed over were seen on the stand of Messrs. B.E.N. PATENTS, LTD. A feature of this stand was the "Ben-Myers" car-washer. This is an electrically-driven outfit by means of which, it is claimed, a car can be washed in 20 minutes. The pump is totally enclosed and runs in oil. All the parts are interchangeable and easily accessible. The water stream can be instantly regulated to any pressure up to 400 lb. per sq. in. A variety of portable electric tools included recently introduced models of electric hand saws with 6-, 8- and 10-in. diameter saw blades; a range of electric drills driven by motors of ¼, ⅓, ½ and 1 h.p. for drilling holes in steel up to 1¼ in.; the "Speedway" portable hammer, a suitable device for drilling in concrete, brick, stone, and so on, made in two sizes, capable of drilling ½-in. and 1-in. holes at 3,000 and 1,800 blows per min., respectively; and the U.L.A. general utility tool with the necessary attachments for grinding, scratching, buffing, sawing, drilling, and other operations. A feature of the apparatus shown was the "Alta" lock mortiser, an electrically-driven apparatus which, it is claimed, will cut an ordinary mortise in less than a minute; stock cutters of ½ in. and 1¼ in. are available for this machine. The "Turner Timer" commutator for Ford automobiles was to be seen on this stand; it is claimed that the long hot spark created by the wide wipe contact results in a saving of 10 to 15 per cent. in petrol consumption. Some "Maimin" electric cloth cutters were also shown; the "Maimin Automatic" cutter employs a straight knife and is carried on a bracket; the "Maimin Six" model is of the circular-knife type and is carried in the hand. Each model carries a guiding lamp. Other exhibits included snap ball joints, and a variety of portable "Alta" electric tools.

Short-circuit Fuse Tests.

On Tuesday next, June 28th, Messrs. Parmiter, Hope and Sugden, Ltd., by the courtesy of the St. James' and Pall Mall Electric Lighting Co., London, will carry out a series of short-circuit tests on their fuses at the Marshall Street, Beak Street, power station of the St. James' Co. Those interested may obtain invitations to be present at the demonstration from the London office of Messrs. Parmiter, Hope & Sugden, Ltd., 25, Victoria Street, Westminster, S.W.1. The tests will be on similar lines to those which took place in Manchester in March last year.

Institution of Civil Engineers' Exhibition.

In connection with the conversazione of the Institution of Civil Engineers, held at the Institution on June 15th, a number of engineering models, pieces of scientific apparatus, &c., were exhibited. Included in the items shown was the Yarrow-Hyde bed which is designed to promote sleep by imitating as far as possible, in amplitude and frequency, the motion of a train on the Canadian Pacific Railway; Sir Alfred Yarrow, the originator of the bed, during a journey from Vancouver to Montreal, found that he slept much better when the train was in motion than when it was still. The bed is hinged at the foot, and a simple harmonic motion is applied to the head of the bed by means of an electrical drive through a double eccentric. At the points of synchronism of the two eccentrics the bed has its maximum and minimum lifts, giving a gradual rise and falling off of the motion. A model for demonstrating the flow of lubricant in a bearing was shown by Prof. B. P. Haigh, D.Sc., and Mr. F. W. Thorne, A.M.Inst.C.E. The Selenyi method of measuring vacuum in electric lamps was exhibited by Mr. J. T. Randall, M.Sc., of the Research Laboratories of the General Electric Co., Ltd. This was also exhibited at the Royal Society's Soiree this year, and described in the ELECTRICAL REVIEW on May 27th, p. 836. The same applies to a new thermostat which was shown by Lt.-Commander F. J. Campbell Allen and Mr. A. E. Salisbury (ELECTRICAL REVIEW, May 20th, p. 792). The National Physical Laboratory had a number of exhibits, which included apparatus for measuring the speeds of vacuum pumps and gas analysis apparatus utilising high-frequency vibrations. Exhibits by Mr. T. Gill, International Standard Electric Corporation, included: apparatus for precision measurements of circuit efficiencies as used on the Anglo-American Transatlantic telephone service; apparatus for comparing the qualities of two loud-speakers; photographs of the radio-telephone equipment at the Rugby radio station; and photographs illustrating the progress of telephony in Spain. An experimental exhibit by Mr. Leonard Andrews, M.B.E., demonstrated the principle of kinetic elutriation, which, it is suggested, may have a field in connection with the use of pulverised fuel. The treatment provides for the disassociation of the particles bound together by surface tension, imparting a high velocity to the particles and passing them through a vortex chamber wherein, under the combined influences of centrifugal force, gravity and eddy currents, they automatically arrange themselves in two separate streams of water, carrying coarse and fine particles respectively.

Smokeless Fuel.

According to the *Morning Post*, the Government has agreed to contribute, under the Trade Facilities Act, a sum which is stated to be £100,000 towards the establishment of a new company to be known as Fuel Utilisation, Ltd. This company will operate works at Richmond for the production, on an experimental basis, of smokeless fuel and motor spirit. The plant has been designed by the Fuel Research Division of the Scientific and Industrial Research Department, and was chosen after an exhaustive investigation of coal distillation plants all over the world. The investigation has been conducted, under the supervision of Sir David Milne Watson, by the Gas Light and Coke Co., which is associated with the new undertaking. The works will be operated intensively for three years to provide working data. At the expiration of this period the results will come under review, and the works will be extended on a commercial basis, or closed down altogether.

Inquiry into an Acton Explosion.

An explosion which occurred at Acton on February 19th last, and resulted in the destruction of premises in Beaconsfield Road, and injuries to the occupants (proving fatal in one case), was the subject of an inquiry which was opened at Acton Town Hall on June 17th, by Mr. G. Scott Ram, M.I.E.E., and Dr. J. S. Haldane, F.R.S., who were appointed by the Electricity Commissioners under the provisions of the Electricity (Supply) Acts, to report upon the matter. The supply is given by the Metropolitan Electric Supply Co., Ltd. The explosion occurred in the early hours of the morning, and about that time a fault developed in the electrical distribution system at that point. The reason for the explosion is obscure. Among the theories put forward is one to the effect that bitumen gas was generated from a feeder cable which was laid in bitumen in the road, and was burned out at one point, and that the explosion was due to the ignition of this gas. On the other hand, it was suggested that the explosion might have resulted from an escape of coal gas. The circumstances with regard to the electrical fault were stated to be as follows. There was a distributor along the road on the opposite side to that on which the destroyed premises were situated, and, parallel with it, a "Dialite" feeder, which latter was laid in bitumen, about twenty years ago, by the Acton U.D.C., before the Metropolitan Co. took over the supply. From the distributor there was a branch at right angles, crossing the road, from which the destroyed premises were supplied. This distributor crossed the feeder. Evidence was given by Mr. A. Richardson (mains foreman to the Metropolitan Co.) to the effect that he had received a telephone message from the substation that a fault was developing on the feeder. The area having been isolated, he found that a fault had occurred in the distributor at the point where it crossed the feeder; the latter was burned away for a distance of about 18 in. on either side of the junction. From a point half way across the road, and in the direction of the feeder, the distributor was bared. He considered that a fault had occurred in the distributor, at a point about half way across the road, and had developed away from the destroyed premises and towards the feeder. When the distributor was taken out, it was found that from the middle of the road to the service box outside the destroyed premises it was in good condition, and the service cable showed no signs of a short circuit. Nine months earlier the occupier of the destroyed premises had complained of an odour, and he (Mr. Richardson) had opened the ground to investigate. On that occasion he had noticed a smell of coal gas, which might have been due to leakage under the ground. Cross-examined by counsel for the Gas Light & Coke Co., witness agreed that there had been trouble with the electrical distribution system at this spot on three occasions in about three years.

Other evidence was given by a number of witnesses, including representatives of the Metropolitan Co., and the inquiry was adjourned until June 20th. The Court intimated that it would inspect the ground in the area affected before the resumption of the proceedings.

Among those who gave evidence on June 20th was Dr. C. J. J. Fox (Messrs. Cross & Bevan, consulting and analytical chemists), who considered it improbable that the explosion was due to bitumen gas; the destruction was out of all proportion to the volume of gas that would be generated. Apart from that, the gas would have been diluted with air to such an extent that the mixture would not have been explosive.

Mr. Hugh Bourne, M.I.E.E. (Messrs. Albion T. Snell and Partners), who gave evidence on behalf of the owner of the destroyed premises, thought that the initial fault took place in the bitumen feeder itself, and that the distributor crossing the road was destroyed as the result of the temperature of the gases generated by the fault in the feeder.

Witnesses were called on behalf of the Gas Light and Coke Co., whose evidence was to the effect that there had been no complaints with regard to the escape of gas in the neighbourhood.

Mr. Frank Hipwell (secretary of the Metropolitan Electric Supply Co.) said that the policy of the company was to

replace the bitumen cables with paper-insulated cables. Approximately £60,000 had been spent on these replacements. It was suggested by Mr. Trevor Watson (on behalf of the Gas Light and Coke Co.) that the company's decision was dictated not merely by financial considerations, but because it knew that bitumen cables were likely to cause danger. Witness did not agree.

Dr. R. V. Wheeler said that, assuming no match had been lit on the premises at the time of the explosion—and the evidence was that no match had been lit—it was just conceivable that the gases rapidly evolved from the bitumen might have been projected through the conduit into the building at a sufficiently high temperature to cause them to ignite of their own accord when they came into contact with air. Another possibility was the presence of an electrostatic charge at the orifice through which the gas flowed, if it were flowing at a sufficiently high speed.

The tribunal will report to the Electricity Commissioners in due course.

Scottish Electrical Contractors.

The annual meeting of the Electrical Contractors' Association of Scotland was held in Glasgow on June 8th; the president, Mr. William Mackintosh (William Douglas, Ltd., Edinburgh), presided. Satisfactory reports were submitted from the branches and the committees of the Central Board, and a substantial increase in membership was again reported. Views were exchanged as to the results of the E.D.A.-E.L.M.A. campaign, and reference was made to the new campaign meditated by E.D.A. for the coming winter. The following new office bearers were elected:—President, Mr. James Allan (Malcolm and Allan), vice-president, Mr. J. J. Foggo (Messrs. John Foggo & Sons). After the meeting the members present were entertained to lunch by the Glasgow Branch in the Royal

Scottish Electrical Contractors.

Hotel, and in the afternoon the usual golf match, East *v.* West, was played at Erskine Golf Course, on the banks of the Clyde. Rain fell heavily on the motor run down to the course, but later the sky cleared. All the members took some part in the match, the non-golfers acting as honorary caddies for the time being. The match resulted in a win for the East by nine matches to six and at a gathering which followed, the Pratt Trophy, which was instituted in 1914, was presented to Mr. A. J. Shand, chairman of the Edinburgh Branch, by the new president, Mr. Allan. Some of the members who took part in the match appear in the accompanying picture.

Week-End Conference.

"Wage Payments and Incentives and Women in Industry" is the subject for discussion to be opened by Miss Caroline Haslett, director of the Electrical Association for Women, and secretary of the Women's Engineering Society, at a week-end conference promoted by the National Industrial Alliance. This gathering has been arranged at the Retreat, Pleshey, Chelmsford, for July 2nd-3rd, 1927. The guests will be equally representative of employers and employés. Accommodation is still available, and particulars will be furnished on application to the Secertary of the Alliance, 25, Queen Anne's Gate, S.W.1.

Electrical Association for Women.

Members of the South Wales and Monmouthshire Branch of the E.A.W., on June 15th, attended a demonstration of clean milking, given under the auspices of the Glamorgan Agricultural Committee, by Miss V. D. Harrison, at Mr. J. H. Merrett's farm at Penylan.

The Electrical Trades Benevolent Institution.

An extraordinary general meeting of this Institution is to be held at 36/38, Kingsway, on Wednesday, June 29th, at 2.30 p.m., to confirm the resolution passed at the annual general meeting held on April 28th that the new rules as submitted be approved and adopted.

Appointments Vacant.

Telephone maintenance inspectors (250 taels per month; tael=2s. 6d.) for the Shanghai Mutual Telephone Co., Ltd. Junior charge engineer for the Gloucester Corporation Electricity Department. Assistant engineer for the Bhatpara Power Co., Ltd. (See our advertisement pages to-day.)

Late Legal.

ALLEGED CONSPIRACY TO DEFRAUD.—At the Mansion House on Tuesday last the adjourned summonses against Sir Charles Buckworth Herne-Soame, Bt., Edward Warden, Col. Edmund Octavius Eaton, and Robert George Harley were again called. The charges against them were that between January, 1914, and the present time they had "conspired together, and with other persons, to cheat and defraud such persons as might receive prospectuses and pamphlets issued by the Chalk Fuel and Gas By-Products Corporation, Ltd."; and of conspiring "to obtain money from them by falsely pretending that certain reports appearing in the prospectuses and pamphlets were true." The prosecution stated that Col. Eaton was unable to attend on account of ill-health, and that Sir C. Herne-Soame, who was prepared to attend, had been advised that his presence was not necessary in view of the other defendant's condition. Harley was in court, but Warden was absent. The summonses were further adjourned until September 21st.

Our Personal Column.

Electrical men are invited to enable us to keep readers of the "Electrical Review" posted concerning their movements

Mr. BANCROFT GHERARDI, vice-president and chief engineer of the American Telephone and Telegraph Co., has been elected president of the American Institute of Electrical Engineers for the year commencing August 1st.

We regret to learn that Mr. JOHN ROBERTS, borough electrical engineer of Durban, has broken down in health. He is now recuperating in the Cape, and, we are pleased to hear, is regaining his health. His assistant, Mr. E. POOLE, has, in the interim, been appointed acting borough electrical engineer.

On the occasion of his marriage, Mr. A. C. WATTS, of Tunbridge Wells, has been presented with a chiming clock by the electrical contractors of Tunbridge Wells, with a similar clock by the electrical contractors of Sussex, and with a coffee service and inlaid tray by the staff of the Premier Electrical Co.

Mr. N. R. KEAST, of Wrexham, has been appointed mains engineer by the Lowestoft Corporation Electricity Supply and Tramways Department.

Mr. A. B. EASON, assistant engineer in the Engineer-in-Chief's Office in the G.P.O., has been promoted to the position of executive engineer.

Obituary.—MR. G. E. TRIPP.—The death occurred in hospital at New York, following an operation, on June 14th, of Mr. Guy E. Tripp, chairman of the board of directors of the Westinghouse Electric and Manufacturing Co. He was 62 years of age. Mr. Tripp was a prominent figure amongst American electrical industrial leaders, and in addition to his connection with various non-electrical corporations, he was also associated with the Radio Corporation of America and the International Radio Telegraph Co. Getting on for twenty years ago he took a foremost part in the reorganisation of the street railway system of New York and during the war he was made a brigadier-general and made huge purchases of materials on behalf of the U.S. Government.

MR. H. MORRIS-AIREY.—We regret to record that Mr. Harold Morris-Airey, C.B.E., M.Sc., M.I.E.E., died at Southsea on Sunday, aged 47 years. For the past seven or eight years he had been chief technical adviser at H.M. Signal School, R.N. Barracks, Portsmouth, where he had been engaged on wireless telegraph apparatus development for the Navy.

MR. W. M. ROGERSON.—We deeply regret to record that Mr. William Michael Rogerson, borough electrical engineer and manager of Halifax, passed away suddenly on Thursday last week. He was present at the convention of the I.M.E.A. at Buxton, but for some time past he had not been in the best of health and after his return home he was obliged to remain there for some days. With the permission of his doctor, we understand, he proceeded to a meeting of his Committee on the morning of the 16th inst., but on entering the Town Hall he had a heart attack, from which he never recovered. Mr. Rogerson, who has thus died in harness, was 55 years of age. He had been at Halifax since November, 1901, proceeding there from Nottingham, where he was chief assistant electrical engineer for seven years. When he took up his Halifax post the plant capacity was 3,000 kW; to-day it is 31,000 kW. He was devoted to his work and took pride in the development of his undertaking and especially in the linking-up of the Halifax and Huddersfield systems. For a short period he was both borough electrical engineer and tramways engineer, but latterly the offices have been separated. Mr. Rogerson acted in an advisory capacity to the Government in connection with the lengthy negotiations in regard to the Aire and Calder electricity district scheme. During the war he was an officer in the Halifax Volunteers. He was a member of the Institution of Electrical Engineers. His numerous friends in the electrical industry will, we are sure, desire to associate themselves with us in our expression of sympathy with his widow and four daughters in their tragic loss. The funeral took place

on Monday. The bearers were six employés of the Electricity Department who had served under him for many years. The flag at the Town Hall was at half-mast. Those present at the funeral, in addition to Mrs. Rogerson, the daughters and other relatives, included a large number of members of the Corporation, Corporation officials, the staff of the electricity works, representatives of the Halifax Electrical Employés' Federation, the Social and Athletic Society of his department, representatives of electrical manufacturing concerns, city and borough electrical engineers from various parts, &c.; 120 employés of the Electricity Department, and 40 tramway employés walked in the procession.

MR. M. COOKSON.—The death has occurred at Kilda, Victoria, of Mr. Maynard Cookson, who for many years was in business as an electrical engineer in Southport. He went to Australia nearly four years ago.

Will.—SIR WM. MACKENZIE, chairman of the Brazilian Traction, Light and Power Co., and various other South American electrical companies, left £17,249 personal estate in England.

Financial Section.

New Companies, Returns of Share Capital, Debenture Changes, Reports of Electrical Companies, Dividend Results, Transactions in Stocks and Shares.

New Companies Registered.

Neutron (1927), Ltd.—Private company. Registered June 11th. Capital, £1,000 in £1 shares. Objects: To carry on the business of manufacturers and buyers and sellers of chemical compounds, metals, and mineral ores; manufacturers of and dealers in mineral ores and other substances used as crystal detectors for wireless receiving sets, and in particular the crystal known as "Neutron"; to acquire the trade marks "Neutron," numbered respectively 452,957, 452,958, 457,747, and 465,321. The first directors are:—P. G. Marr, "Crossways," Whiteman's Green, Cuckfield, Sussex, merchant; W. Holt, address not stated; C. J. S. Norris, "Maylus," Norbury Crescent, S.W.16, C.A. Qualification: 1 share. Solicitors: John Hands & Son, 97, Gresham Street, E.C.2.

J. & C. Manufacturing Co., Ltd.—Private company. Registered June 9th. Capital, £1,250 in 750 ordinary "A" shares of £1 each, and 1,000 ordinary "B" shares of 10s. each. Objects: To acquire the business of manufacturers of and dealers in wireless telephony appliances now carried on by the proprietors of the J. & C. Wireless Company at Brighton. The first directors are:—N. G. Johnson, Le Pride, Henfield, Sussex; C. L. Clayton, Badger Wood, Fulking, Sussex; C. Hastings, 7, Northfield Road, Stamford Hill, N.; Secretary: C. Hastings. Solicitors: F. H. Nye, 15, Prince Albert Street, Brighton. Registered office: Royal Crescent Works, Marine Parade, Brighton.

Devereux, Ltd.—Private company. Registered June 13th. Capital, £1,000 in £1 shares. Objects: To acquire the business of an electrical engineer and manufacturer carried on by H. Devereux, at 1, Yukon Road, Balham, as "The Ajax Company," and to carry on the business of repairers of and dealers in electrical machines, including wireless telephony and telegraphy, &c. The first directors are:—H. Devereux (permanent managing director and chairman), 101, Tooting Bec Road, Upper Tooting, S.W.17, electrical engineer; E. le Maistre, 2, Furzedown Drive, Tooting Bec Common, S.W.17, general practitioner. Registered office: 1B, Yukon Road, Balham, S.W.12.

Mercury Electrical Appliances, Ltd.—Private company. Registered in Edinburgh June 17th. Capital, £500 in £1 shares. Objects: To carry on the business of electricians, mechanical engineers, &c. The directors are:—H. Manfred, 8, Westmorland Street, Glasgow, chemist; W. Morrison, 524, Cathcart Road, Glasgow, traveller. Qualification, 50 shares. Registered office: 158, Howard Street, Glasgow.

South American Public Utilities Trust, Ltd.—Private company. Registered June 14th. Capital, £110,000 in 80,000 ordinary shares of £1 each and 120,000 8 per cent. cumulative preference shares of 5s. each. The preference shares have priority for return of capital. Objects: To acquire shares, stocks, and securities of any company (wherever incorporated) formed for the purpose of constructing, purchasing, leasing, or otherwise acquiring, maintaining and working in any part of South America, tramways, railways, omnibuses, or other form of public transport, or of generating and supplying electricity for light, heat, power, and other purposes; to hold, sell, dispose of, or deal in such shares and securities; to construct or acquire, maintain and work tramways, railways, and omnibuses, and to generate and supply electricity in any part of South America, &c. The subscribers (each signing for one preference share) are:—D. Kemsley, Thrifts Hill, Theydon Bois, Essex, gentleman; E. J. McLellan, 130, Church Road, Upper Norwood, S.E., gentleman. Solicitors: Johnson, Jecke and Colclough, 24, Austin Friars, E.C.2.

Tully Gas Plants (1927), Ltd.—Public company. Registered June 16th, with a nominal capital of £140,000 in 300,000 10 per cent. non-cumulative participating preference shares of 1s. each and 500,000 ordinary shares of 5s. each. The objects are to acquire the undertaking and assets of Tully Gas Plants, Ltd., to adopt an agreement between Gas & Fuel Plants, Ltd., and its liquidators of the first part, Tully Gas Plants, Ltd., and its liquidator of the second part, Low Temperature Carbonisation, Ltd., of the third part, and J. Morgan, as trustee for and on behalf of the company, of the fourth part, and to carry on the business of gas, electrical, mechanical and general engineers, contractors, electricians, founders, smiths, manufacturers and suppliers of and dealers in gas, electricity, motive power, water and light, &c. The minimum cash subscription is 7 ordinary shares. The first directors are:—F. R. Wade, The Priory, Redbourne, Herts.; C. H. Parker, The Glen, Codsall, near Wolverhampton. Qualification (except first directors), £10 shares or stock. Remuneration: £150 each per annum (chairman £50 extra), free of income tax. Secretary: J. H. Macaulay. Solicitors: Jenkins, Baker & Co., 3, London Wall Buildings, E.C.2. The registered office is at 3 and 4, Clement's Inn, Strand, W.C.2.

Brockbank & Powell, Ltd.—Private company. Registered June 15th. Capital, £2,100 in 2,000 5 per cent. non-cumulative preference shares of £1 each and 2,000 ordinary shares of 1s. each. Objects: To carry on the business of importers, exporters, consulting and general engineers, mechanical, metallurgical, electro-metallurgical, and electrical engineers, &c. The first directors are:—C. J. Brockbank, F.C.I.C., 1,039, Oak Lane, Philadelphia, Pa., U.S.A., metallurgical chemist; H. H. Powell, A.M.I.E.E., Palace Chambers, Bridge Street, Westminster, S.W.1, engineer (both permanent, subject to each holding one share). Solicitors: Godfrey and Robertson, 40, Chancery Lane, W.C.2. Registered office: Palace Chambers, Bridge Street, Westminster, S.W.1.

Radi-Arc Electrical Co. (1927), Ltd.—Private company. Registered June 15th. Capital, £1,000 in £1 shares. Objects: To carry on the business of electrical and mechanical engineers, designers, &c. The directors are:—S. Blaiberg, 42, Fairhazel Gardens, Hampstead, N.W.6; Violet Erdman, 65, Fitzjohn's Avenue, Hampstead, N.W.3. Solicitors: A. W. Osmond, 6, South Square, Gray's Inn, W.C. Registered office: Bennett Street, Chiswick, W.4.

Reid Power Development Co., Ltd.—Public company. Registered on June 16th, with a nominal capital of £25,000 in 23,000 10 per cent. preferred participating ordinary shares of £1 each and 40,000 deferred ordinary shares of 1s. each. The objects are to acquire a licence from Electric Bulk, Ltd., to develop and form a company to erect a super-power station under the Reid Power process, and to carry on the business of promoting electricity and lime producing, and generally that of a contracting, commercial, financial, developing and producing association, especially with regard to electrical, lime, scientific, and geological matters, &c. The minimum cash subscription is 7 preferred participating ordinary shares. The first directors are:—Lt.-Col. the Hon. H. Scott Davey, C.M.G., 9, Somerset Place, Bath; Major Arthur H. Wodehouse, 32, Upper Gloucester Place, Dorset Square, N.W.1. No share qualification required. Remuneration, £100 each per annum (chairman £150). Secretary: R. Elliott. The registered office is at 30, St. Swithin's Lane, E.C.4.

Official Returns of Electrical Companies.

Frank Craft (Castleford), Ltd.—E. V. Williamson, of 7, Greek Street, Leeds, ceased to act as receiver and manager on May 31st, 1927.

Racon Electrical Co., Ltd.—Capital, £100 in £1 shares. Return dated December 9th, 1926 (filed March 8th, 1927). All shares taken up. £100 paid. Mortgages and charges, nil.

Simmonds & Stokes, Ltd.—Capital, £10,000 in £1 shares. Return dated February 14th, 1927. 7,521 shares taken up. £1,521 paid, £6,000 considered as paid. Mortgages and charges at date of return: £3,350. Since issued: £50 debentures on March 29th, 1927.

Martletts, Ltd.—Capital, £6,000 in 5,000 preference shares of £1 each and 40,000 ordinary shares of 6d. each. Return dated December 31st, 1926 (filed January 12th, 1927). 3,002 preference and 40,000 ordinary shares taken up. £1,352 paid (being 9s. per share on 3,000 preference and £1 on 2 preference shares), £1,000 considered as paid on 40,000 ordinary shares. Mortgages and charges, nil.

Cymbal, Ltd.—Capital, £200 in 2s. shares. Return dated December 31st, 1926 (filed March 18th, 1927). 1,000 shares taken up. £100 paid. Mortgages and charges: £163 5s. 3d.

Duff Bros., Ltd.—Capital, £2,100 in 2,000 "A" ordinary shares of £1 each and 1,000 "B" and 1,000 "C" shares of 1s. each. Return dated January 12th (filed April 5th), 1927. All shares taken up. £2 paid, £2,098 considered as paid. Mortgages and charges, nil.

Illuminated Advertising Co., Ltd.—Capital, £1,000 in 500 preference and 500 ordinary shares of £1 each. Return dated March 1st, 1927. 500 ordinary and 478 preference shares taken up. £978 paid. Mortgages and charges, nil.

Philips Lamps, Ltd.—Capital, £50,000 in £1 shares. Return dated June 9th (filed December 6th), 1926. All shares taken up. £50,000 paid. Mortgages and charges, nil.

Electro-Mechanical Supplies, Ltd.—Capital, £3,000 in £1 shares. Return dated January 14th, 1927. 999 shares taken up. £999 paid. Mortgages and charges, nil.

Atmos Electrical Co., Ltd.—Capital, £2,000 in 1,000 preference and 1,000 ordinary shares of £1 each. Return dated December 4th, 1926. 750 ordinary shares taken up. £250 paid, £500 considered as paid. Mortgages and charges, nil.

Luminograph Co., Ltd.—Capital, £1,000 in £1 shares. Return dated January 14th, 1927. All shares taken up. £1,000 considered as paid. Mortgages and charges: £1,500.

Power Securities Corporation, Ltd.—Capital, £2,000,000 in 1,000,000 preference and 1,000,000 ordinary shares of £1 each. Return dated March 2nd, 1927. 500,000 preference and 500,000 ordinary shares taken up. £1,000,000 paid. Mortgages and charges, nil.

Wakelins Wireless Co., Ltd.—Capital, £2,500 in 1,250 ordinary and 1,250 preference shares of £1 each. Return dated December 14th, 1926. 135 ordinary shares taken up. £102 paid. £33 considered as paid. Mortgages and charges, nil.

District Lighting Supply, Ltd.—Capital, £1,000 in £1 shares. Return dated December 31st, 1926 (filed April 28th, 1927). All shares taken up. £1,000 considered as paid. Mortgages and charges, nil.

Read & Morris, Ltd.—Capital, £2,000 in 1,940 ordinary shares of £1 each and 1,200 founders' shares of 1s. each. Return dated December 31st, 1926 (filed March 23rd, 1927). 1,200 founders' shares taken up. £30 paid. £30 considered as paid. Mortgages and charges, nil.

Willet & Robinson, Ltd.—Capital, £7,000 in 3,000 "A" cumulative preference, 1,000 "B" preference, and 3,000 ordinary shares of £1 each. Return dated August 19th, 1926 (filed March 22nd, 1927). 2,000 "A" cumulative preference and 2,000 ordinary shares taken up. £4,000 paid. Mortgages and charges, £390.

Acme Electric Lamp Co., Ltd.—Capital, £1,000 in £1 shares. Return dated June 30th, 1926 (filed April 16th, 1927). All shares taken up. £2 paid. £998 considered as paid. Mortgages and charges, £2,551.

G. S. Hawker, Ltd.—Capital, £1,000 in £1 shares. Return dated April 4th, 1927. 750 shares taken up. £250 paid. £500 considered as paid. Mortgages and charges, £900.

Tungsram Electric Lamp Works (Great Britain), Ltd.—Capital, £100 in £1 shares. Return dated February 28th, 1927. 10 shares taken up. £10 paid. Mortgages and charges, nil.

Electro-Plant, Ltd.—Capital, £1,000 in £1 shares. Return dated December 31st, 1926 (filed April 13th, 1927). Two shares taken up. £2 paid. Mortgages and charges, nil.

Sherborne Electric Supply Co., Ltd.—Capital, £15,000 in £1 shares. Return dated April 7th, 1927. 12,031 shares taken up. £12,031 paid. Mortgages and charges, nil.

Bann Syndicate, Ltd.—Capital, £10,000 in £1 shares. Return dated January 14th, 1927. 8,002 shares taken up. £8,002 paid. Mortgages and charges, nil.

Schall & Sons, Ltd.—Particulars filed of £12,000 debentures authorised June 8th, 1927, charged on the company's undertaking and property, present and future, including uncalled capital, the whole amount being now issued.

Bordesley Electrical Accessories Co., Ltd.—Capital, £5,000 in £1 shares. Return dated March 4th, 1927. 4,812 shares taken up. £2,500 paid. £2,312 considered as paid. Bank overdraft, £1,509 10s. 9d.

Accumulators (Birmingham), Ltd.—S. R. Worley, of 23, Bush Lane, Cannon Street, E.C., ceased to act as receiver or manager on June 3rd, 1927.

Rose Bros. Electrical Co., Ltd.—T. G. Weavers, of 4, Drapers' Gardens, E.C., was appointed receiver and manager on June 7th, 1927, under powers contained in debenture dated July 1st, 1925.

Whittaker Bros., Ltd.—Capital, £7,000 in 1,000 cumulative, 5,000 "A" ordinary, and 1,000 "B" ordinary shares of £1 each. Return dated December 31st, 1926. 3,907 (class not stated) shares taken up. £3,207 paid. £700 considered as paid. Mortgages and charges, nil.

Liskeard Gas and Electricity Co., Ltd.—Memorandum dated June 1st, 1927, endorsed on debentures dated January 21st, 1926, securing increase in rate of interest from 5 per cent. to 6 per cent.

General Radio Co., Ltd.—Particulars filed of £20,000 debentures authorised June 3rd, 1927, and covered by trust deed of same date, charged on the company's undertaking and property, present and future, including uncalled capital, the amount of the present issue being £15,000 (at 2 per cent. discount). Trustees: Redeemable Securities Investment Trust, Ltd., Broad Street House, E.C.

City Notes.

Callender's Cable and Construction Co., Ltd.

The balance of profit for the year ended December 31st last is £356,525, as compared with £368,644 in 1925. After providing for interest, depreciation, preference dividends, &c., and adding the balance brought forward (£611,338, less £329,022 transferred to reserve), there is a balance of £496,287 available. From this a dividend of 15 per cent. is declared (5 per cent. already paid) on the ordinary shares, leaving £376,287 to be carried forward. An increase of £300,000 in the capital was authorised in June last year; 200,000 shares have been issued as a bonus to the shareholders, leaving 200,000 available for future issue. The company's operations were seriously affected by the general strike and the coal stoppage. The factory was entirely closed for several days, chiefly owing to the failure of the power supply. Subsequent manufacture at Erith was seriously hampered by difficulty in obtaining supplies and by costly and inadequate transport. Consequently there was a small decline from the record profit of 1925, but in the circumstances the directors consider the result satisfactory. The operations at the Anchor Works were less seriously interrupted, as they were able to carry on without cessation of production. They also suffered, however, from increased costs of supplies and transport, and had shown a reduction of profit. The report refers to the passing of the Electricity (Supply) Act and the commencement of operations by the Central Electricity Board, and says that meanwhile several of the existing undertakings are making large developments, and considerable orders have been placed with the company for work thus resulting. Since the beginning of the year there has been a strong and healthy demand for cables and wires, and both the Erith and Leigh factories were well occupied and in excellent condition. It has taken longer than was anticipated to bring the Okonite-Callender Co. of America into full and profitable operation, owing largely to the changed condition of the cable industry in the United States, where new methods and standards have been adopted which have entailed considerable changes in that company's production and policy. In the meantime, however, the company has secured many large contracts and is producing cables of the highest quality of the type and for the pressures now required in America. The directors regret that Mr. A. W. Tait, C.B.E., has, owing to his other engagements, found it necessary to retire from the board. They desire to place on record their high appreciation of the services which Mr. Tait rendered to the company during the period of his association with it. Meeting: June 30th.

W. T. Henley's Telegraph Works Co., Ltd.

The accounts for the year ended March 31st last show a profit of £306,985 (against £311,029 in 1925-26). After providing for debenture interest, depreciation, &c., and adding £503,779 brought forward (less directors' bonus, £2,500), the amount available is £753,055. From this £50,000 is transferred to reserve, and income tax is paid, as well as the preference and interim ordinary dividends, leaving £619,953. The directors recommend a final ordinary dividend of 2s. 6d. per share (making 4s., or 20 per cent., for the year), together with a bonus of 1s. per share. This will leave £506,203 to be carried forward. Satisfactory progress was made during the year, although some inconvenience and additional expenditure were caused by the industrial troubles. The directors do not consider it necessary to increase substantially the amount carried forward, and accordingly recommend the payment of a cash bonus. Sir George Sutton, Bt., has retired from the office of managing director, but continues to supervise the business as active chairman. Mr. A. E. Salmon, who has been for many years secretary of the company, has been elected a director, and will continue to devote his whole time to the service of the company. Meeting: July 1st.

Greenwood & Batley, Ltd.

A final dividend of 2½ per cent. has been declared, making 5 per cent. for the year, as for 1925-26.

Telephone Manufacturing Co., Ltd.

The annual meeting was held on June 17th, Mr. F. T. Jackson (chairman) presiding. In presenting the report and accounts (ELECTRICAL REVIEW, June 10th, p. 941) Mr. Jackson said that the balance sheet of the British Installation Companies showed satisfactory results considering the industrial troubles of last year. An increased profit had been earned, and their indebtedness to the company had been reduced by £19,000 to £78,000. The business done by the subsidiaries during the first five months of the current year showed a substantial increase, and that improvement was expected to continue. The effects would not all be felt in the current accounts, for the contracts were spread over a period of years. The Australian subsidiary had now recovered and was earning satisfactory profits. The Continental Companies had also made small profits, and were gradually reducing their indebtedness to the parent company. As so large a contingency reserve was not now necessary, part of it was being used to write off premiums and expenses on the bonds redeemed, and that item was cleared out of the balance sheet. £12,000 had been written off out of profits for obsolete apparatus. The parent company had secured a number of substantial contracts during the year, but their completion was delayed by the general strike, and a considerable volume of orders was carried forward to 1927. Mr. Jackson criticised the short-sighted policy of the Government in delaying telephone development. Competition was very keen in the automatic telephone business, but the company refused to take orders which did not hold out the prospect of a reasonable profit. He condemned the present policy of confiscating surplus revenue earned by the telephone service, stating that it should be used for development purposes, and he considered that the Government was not the proper body to run the system. He suggested an organisation on the lines of the Metropolitan Water Board or the Port of London Authority. Capital could be raised by the issue of telephone bonds at a fixed rate of interest. With the present lack of orders, experienced men had to be discharged, and when work did come a new body of men had to be trained. With regard to the company's future, the chairman said that it seemed as though it would continue to be fairly busy for some time to come. Apart from public telephone work, it had other work which was growing and expanding.

British Empire Trust Co., Ltd.

Addressing the shareholders at the annual meeting on June 14th, Mr. J. Davidson (deputy chairman and managing director) said that they had been able to increase the preferred ordinary dividend from 5 to 6 per cent. and the deferred ordinary dividend from 7 to 8 per cent., and to transfer £100,000 to reserve. The time had come when they could revert to the payment of interim dividends. He proceeded to review the position of the companies in which they were interested. The British Columbia Electric Railway Co., Ltd., he said, continued to expand, and the outlook for the current year was encouraging. The West Gloucestershire Power Co. was similarly situated. Political conditions in Mexico showed little, if any, improvement, but in spite of that the business of the Monterey Railway, Light & Power Co. increased during the past year, and the company was able to continue the payment of interest on its "A" first mortgage debenture stock and provide for the sinking fund relating to that stock. The new Canadian & Foreign Securities Co. should be as successful as the old Canadian Northern Prairie Lands Co. The report of the Canadian Western Lumber Co. was satisfactory. The Winnipeg Electric Co. was favourably placed, and had successfully conducted a customer-ownership campaign. The chairman concluded with a reference to the company's Canadian gas interests.

Whitehall Electric Investments, Ltd.

The report of this company was reviewed in our last issue (p. 985). The annual meeting was held on June 16th, when the Hon. Clive Pearson (chairman), who presided, said that in five years they had written off £695,000 in respect of debenture discount and stamp duties, leaving only £36,766 to be dealt with. After visiting Chile, he (the chairman) was well satisfied with the company's properties. The directorates of the Chilena and Valparaiso companies were confident that they were only at the threshold of the business which lay before them. Excellent progress had been made with the 22,000-kW hydro-electric plant on the Maipo river, and it was felt to be certain that the plant would be in operation by April next. Although Mexican conditions had not improved the companies in which they were interested reported relatively satisfactory results. The company's income for the past two years had been derived as to 80 per cent. from Chile and 20 per cent. from Mexico. He believed that there would be a satisfactory outcome of the present situation in Mexico and that there would be an improvement in income from that source.

Sphere Investment Trust, Ltd.

The report of this company (formerly the United Electric Tramways of Montevideo, Ltd.) for 1926 states that the whole of the company's tramway interests in Montevideo and some other assets have been sold to the Atlas Light & Power Co., Ltd. The outstanding debenture stock was satisfied by 5 per cent. debenture stock of the Atlas Co. The Trust has now no debenture stock outstanding, and possesses 450,000 7 per cent. cumulative preference shares and 500,000 ordinary shares of £1 each of the Atlas Co., with certain other investments. The change of name and the subdivision of the £5 shares were confirmed by the Court in March last. The revenue account for 1926 shows a credit balance of £33,872, taking no account of any final dividend to be declared on the ordinary shares of the Atlas Co. The directors recommend the payment of a dividend of 2 per cent. on the ordinary shares, leaving £1,872 to be carried forward. The retirement of Mr. H. F. Gunning from the board and the appointment of Messrs. D. M. Touche and A. J. Side as directors are mentioned in the report. Meeting: To-day (Friday).

Delhi Electric Tramways and Lighting Co., Ltd.

The combined net revenue of the tramway and lighting undertakings for 1926 amounted to £49,539, as compared with £45,019 for 1925. After crediting profit on exchange, &c., deducting general expenses and debenture interest, and adding £2,142 brought forward, there remains £51,849. The general reserve receives £15,001, depreciation and renewals £14,024, taxation reserve £7,000, and employés' provident fund £585. Dividends of 12 per cent. on the preferred and participating shares and 11.1724 per cent. on the ordinary shares are recommended, absorbing the whole of the available balance. A draft agreement for a bulk supply from the Government generating station is in the company's possession. Mr. A. W. R. Lovering was appointed a director during the year. Meeting, June 28th.

Fellows Magneto Co., Ltd.

The annual meeting was held on June 15th. Mr. V. L. Fellows (chairman) presided and presented accounts covering the two years ended December 31st last. He said that during 1925 the company ceased to make magnetos, and the directors were unable to present a balance sheet until the plant was written off. It was finally disposed of in February last. Since January 1st, 1926, they had established twelve successful provincial branches, and sales were showing a steady increase. The whole of the working capital was now really provided by the bank, which was requiring the reduction of its advances. After some discussion the report was adopted, and subsequently resolutions were carried providing for the reconstruction of the company upon the lines mentioned in our issue of June 10th, p. 941.

New Issue.

Lancashire Electric Light & Power Co., Ltd.—On Tuesday last this company offered for subscription £1,000,000 of 5 per cent. redeemable debenture stock at the price of £95 per cent. The stock is redeemable in 1980 or earlier at the option of the company. The proceeds are to be applied in providing for the purposes of the undertaking, including the erection of a power station at Kearsley and repaying bank advances. The initial plant at the Kearsley station will comprise four 42,000-h.p. sets and provision is to be made for the installation of two further sets. The first portion is expected to be put into operation by the end of 1929. Last year the company had a maximum demand of 80,000 h.p. on a plant capacity of 103,000 h.p.; the amount of energy sold was 146,580,000 kWn. The issue having been over-subscribed many times, the list was closed at 10 a.m. on Tuesday.

Aron Electricity Meter, Ltd.

The accounts for the past year show a net profit of £9,041 (as compared with £11,424 in 1925), and to this is added a balance of £2,942 brought forward, making £11,983. It is proposed to transfer £1,000 to reserve (against £3,000) and to pay a dividend of 6 per cent. on the ordinary shares (the same), leaving £2,376 to be carried forward. Meeting: June 28th.

Ransomes, Sims & Jefferies, Ltd.

The profit for the year ended March 31st last was £18,887 and the addition of £58,599 brought forward makes available £77,486. The directors do not feel justified in recommending the payment of an ordinary dividend, and after transferring £10,000 to reserve propose to carry forward the balance of £56,487.

Stock Exchange Notices.

Application has been made to the Committee to allow the following to be officially quoted:—

London Electric Supply Corporation.—199,800 ordinary shares of £1 each, fully paid, Nos. 499,501 to 699,300.

Pennsylvania Water and Power.—429,848 shares of capital stock of no par value.

Cape Asbestos Co., Ltd.

From the 1926 profits (amounting to £36,766 plus £10,491 brought forward), £15,000 has been transferred to reserve; a dividend of 10 per cent. is recommended on the ordinary shares and a similar dividend on the preference shares. £11,757 is carried forward.

United Water Softeners, Ltd.

Out of a profit of £20,770 for 1926 (against £19,091) the directors are again paying an ordinary dividend of 2s. per share, free of tax. The shareholders are offered, at 15s. each, 36,750 £1 shares in the Buell Combustion Co., which the company has received for its "Kek" interests.

British Electric Traction Co., Ltd.

This company's annual meeting was held on Tuesday last. A report will appear in our next issue.

Kidderminster and District Electric Lighting and Traction Co., Ltd.

The total net receipts for 1926 were £7,545, and to this figure is added £454 brought forward, making £7,999. Of this £1,000 is allocated to renewals, and £800 to reserve. The directors propose to pay an ordinary dividend of 2½ per cent. and carry forward £465. After providing for renewals, the profit of the Kidderminster & Stourport Electric Tramway Co. is £99. This is added to £625 brought in and the whole is carried forward.

Chile Telephone Co., Ltd.

It was reported last week that the purchase of the company's business by the International Telephone & Telegraph Corporation had been completed. The latter has already acquired control of All-American Cables, Inc., and the Montevideo Telephone Co., Ltd.

Guest, Keen & Nettlefolds, Ltd.

The net profit for the year ended March 31st last fell from £948,298 to £909,278. The balance brought forward is £235,639, which makes available £1,144,917. The ordinary dividend is maintained at 10 per cent. free of tax, and £208,451 is carried forward.

Anglo-Argentine Tramways Co., Ltd.

A dividend of 2s. 9d. per share has been declared on the 5½ per cent. first preference shares and one of 3s. per share on the 6 per cent. second preference shares, in respect of the half-year ending June 30th.

James Keith & Blackman Co., Ltd.

The directors report improved business during 1926, the net profit amounting to £35,806, as compared with £25,858 for 1925. The ordinary dividend is raised from 10 to 12½ per cent. and the amount put to reserve from £5,000 to £8,000.

Dorman, Long & Co., Ltd.

The directors have again decided to pass the dividend on the non-cumulative preferred ordinary shares, and consideration of the payment of the dividend on the cumulative preference shares is postponed.

Lancashire Dynamo and Motor Co., Ltd.

The holders of the company's debentures are being asked to agree to the postponement of the redemption date for 20 years from June 30th. In consideration of this it is proposed to raise the rate of interest from 5 to 6 per cent.

International Light and Power Co., Ltd.

A dividend of 3 per cent. (less British tax) has been declared on the preference shares in respect of the half-year ending June 30th.

Falkirk Iron Co., Ltd.

From the 1926-27 profits the directors propose to pay a final dividend of 5 per cent., making 10 per cent. for the year as for 1925-26. £10,000 is placed to reserves and £35,596 carried forward.

Lisbon Electric Tramways, Ltd.

The half-yearly dividend has been declared on the 6 per cent. cumulative preference shares.

Swedish-Mexican Company.

The report for 1926 of the *Mexikanska Telefon a.b. Ericsson* states that development proceeded very satisfactorily. Hitherto the company has only carried on the telephone business in Mexico City and environs, but during 1926 an interurban concession was granted for the whole of the republic and for the installation of telephones throughout the country. In order to finance this extension, which has already begun, the share capital has been increased from 5,400,000 kr. to 10,800,000 kr. The net profits are returned at 1,127,000 kr., as compared with 970,000 kr. in 1925, and the dividend is 10 per cent. on the increased capital, as against 12 per cent. on half of this capital in 1925.

German Company.

The *Accumulator Works Company*, Berlin-Hagen, reports that the stagnation in sales in 1925 continued in the first half of 1926, but in the second half a revival took place in automobile and radio batteries. The turnover in large stationary batteries continued to be unsatisfactory. The export business did not improve, and only the hope of better times justified the maintenance of the export organisation. The accounts show net profits of 1,991,000 marks, as compared with 1,929,000 marks in 1925, the dividend remaining at 8 per cent. on the share capital of 20,000,000 marks.

French Companies.

The *Etablissements Gaiffe-Gallot et Pilon* report net profits of 1,727,000 fr. for 1926; the dividend is 60 fr. per share.

The *Société l'Appareillage Electro-Industriel* (*Petrier Tissot et Raybaud*) has decided to pay a dividend of 20 fr. per share out of net profits of 770,000 fr. for 1926.

The *Compagnie Lorraine de Charbons, Lampes et Appareillages Electriques* records net profits of 691,000 fr. for 1926; the dividend is 15 fr. per share.

Stocks and Shares.

MONDAY EVENING.

When Money Matters.

WITH the near approach of the end of June, it is usual for money conditions to become a little strained, owing to the ordinary seasonal requirements for window-dressing and other purposes. Banks and private firms who have had money out on loan sometimes make the end of June, as they do the end of the calendar year, a convenient peg upon which to hang requests for repayment, and to curtail facilities which would be in the ordinary way granted with little hesitation. Experience looks for tightening of money rates at this time of the year, a tendency that reacts, of course, upon Stock Exchange prices, more particularly those of the gilt-edged variety. Speculative stocks and shares are less influenced by purely financial considerations, though in their case, as in that of the investment securities, the contraction of contango facilities serves to check enterprise on the part of those who look to such assistance for the financing of their commitments.

Brazilian Tractions.

In view of the enormous amount of new capital which has been issued for public subscription during the past few months, and the fact that a good many of the recent comers are still partly paid, the firmness of Stock Exchange markets as a whole is significant of the public's willingness to invest money and of their ability to pay for their purchases. Brazilian Tractions continue amongst the liveliest of the speculative counters, and, although the price has gone back 8 points to 167, this reaction is comparatively trifling in view of the extraordinary rise that has taken place in the shares over the past three months. No fresh developments have been reported from the company, but the market is wedded to the idea that, before long, there will be some kind of bonus, in addition to an increase in the present dividend rate of 6 per cent. per annum. The preferred shares have moved in consonance with the common shares, and are down 7 points at 146.

Ex Dividend Recoveries.

British Electric Traction ordinary has gained another 2 points at 153, there being a steady pressure to buy the stock and a small amount of floating supply on offer in the market to meet the demand. The 6 per cent. preferred has risen to 121¼. No changes have occurred in the London group of traction issues. Districts have gone ahead to 63½. A good many stocks and shares are quoted ex the interest and dividends due at this time of the year, amongst these being both classes of Anglo-Argentine Tramways preference and British Columbia Electric preferred and deferred. The disposition is for dividend deductions to be recovered, at any rate in part, almost as soon as they are taken off the prices, from which it is evident that when the quotations are marked ex, the yield on the reduced valuation attracts prompt attention and leads to inquiries for the stocks and shares affected.

New Issues.

New issues continue to make their appearance, though at a slower rate than has recently been the case. The Lancashire Electric Light and Power Company has been offering 5 per cent. debenture stock at 95, a well-secured investment and one that is likely to appeal to the buyer of sound industrial issues. The stock made its appearance under auspices which suggest that, as soon as the stags have completed their operations and the market has settled into a normal condition, there is likely to be a premium of a point or two as the stock becomes absorbed by hands that will hold it permanently. The West Midlands Joint Electricity Authority has been offering two million pounds 5 per cent. stock at 98, of which a quarter is to be allotted fully-paid in part payment of properties to be acquired, and the other 75 per cent. was available for public subscription. The Authority will operate in an area covering a thousand square miles in Staffordshire, Shropshire and Worcestershire, and at the outset will possess generating plant which last year produced nearly 125 million kWh. The first interest payment is one of 12s. 6d. per cent., due in October this year. Redemption at 100 will take place in 1968 or any time after 1948 at the same figure. Underwriters were left with 60 per cent. of their obligations, and the price of the scrip is 1 discount.

London Electrics.

Competition from these newcomers affected the price of the new County of London Electric 5 per cent. debenture recently issued at 96. The premium diminished to about ¾, at which price the stock is obtainable in the market free of stamp and fee, to give £5 3s. per cent. on the money. The first interest payment is one of 28s. 1d. per cent., payable in December this year. No changes occurred in the price of Lancashire shares, which remain at 26s. middle, but Notting Hill preference, which so rarely move, put on 5s. to 10¼, upon a small demand. Edmundsons improved upon their last week's rise, going ahead to 29s. 6d., and the company's preferences strengthened to 24s. Bournemouths parted with a portion of their improvement, coming on offer at £3 a share. No movements of importance have occurred in the London group, a drop of 6d. in City Lights to 27s. being balanced by an advance of the same amount in Kensingtons to 25s. 6d. Yorkshire (West Riding) preference strengthened to 13s. 9d.

The Telephone Octopus.

It was announced from Santiago last week that the sole ownership of the Chile Telephone Company has been acquired by the American International Telephone and Telegraph Corporation as the result of negotiations in London. These negotiations, it need scarcely be said, have been reflected in the steady rise which has lifted the price of Chile Telephones to 7¼, at which the yield on the money, on the basis of the last dividend, is a meagre 3¼ per cent. The American International Telephone and Telegraph Corporation is a keen buyer of telephone companies throughout South America, and not long ago acquired control of the Montevideo company. Lately, the remarkable advance in the price of United River Plates has been ascribed to purchases made for the probable purpose of obtaining control by the same omnivorous corporation. The United River Plate report showed an increase of £50,000 on the company's profit last year, to £455,000. The company's meeting, held on Tuesday in this week, was awaited with great interest, it being expected that the chairman would make some reference to the presumed angling by the American concern for the United River Plate company.

Telephony at Home.

Telephone Manufacturing shares, which had a severe fall earlier this month on the issue of a report that was disregarded as disappointing, have been a firmer market round about 7s. The shares are of the nominal value of 10s. each, and the company, having recently paid off its debentures, was expected to be able to declare a modest dividend on the ordinary shares in respect of the year recently ended. This, however, as already mentioned, the directors were unable to recommend. At the meeting last Friday the chairman accused the Government of curtailing expenditure in a Department, that is, the telephone, which is not only revenue-producing, but of importance in assisting revival in trade. He maintained that the telephone service should be handed over to a body run on similar lines to the Metropolitan Water Board or the Port of London Authority, with a man at the head of it who shall be the best business man obtainable, regardless of salary. Additional capital for the telephone service, he argued, could be obtained from the investing public in the shape of telephone bonds. It has long been a matter for criticism, of course, that this country should lag behind other parts of the world in the provision of cheap and efficient telephony. Automatic Telephones are steady at 47s. 6d., and Internationals remain at 39s. 6d.

Wireless.

The rise in Marconis suffered a sharp check, as mentioned last week, upon the opposition that has redeveloped in connection with the arrangements that the directors desire to make in connection with placing the capital account upon a sounder basis. Marconis went back to 20s., but Canadian Marconis, which rumour declares to be the object of desire to the Radio Corporation of America, keep up steadily at their advanced price of 5s. 6d. Other wireless shares are quiet. India-Rubber, Gutta-Percha shares have fallen 2s. 6d. to £1, in consequence of the announcement that no interim payment will be paid on the ordinary shares.

"Dollar" Stocks.

Henleys hold their substantial advance at 4¾, on the increase in the dividend and the important contracts which the company has just secured from the Great Indian Peninsula Railway and the Eastern Telegraph Companies. Whitehall Electric preference remain at 20s. 6d., being a rather better market on the statement by the Hon. Clive Pearson at last week's meeting to the effect that 80 per cent. of the company's income has been derived from Chile and rather under 20 per cent. from Mexico. This sets at rest the doubt which had been felt in regard to the amount of the stock which the Whitehall company possesses in Mexico. The chairman declared his belief that the Mexican Government realises that recent legislation is detrimental to the well-being of the country, which, with its population of 15 millions and great resources, feels the vital necessity for the development which electrical power offers. Mexico Tramways common shares are 2 better, at 26. Amongst other "dollar" stocks, St. Maurice Power 6½ per cent. first debentures are 3 higher at 105. Quebec Power 6 per cent. "A" debentures hardened to 105¼. Shawinigan common have gone back to 89¼.

Points.

Lisbon Electric Trams rose to 21s. 6d. on the declaration of a 3 per cent. dividend, making 6 per cent. for the year, and the pleasant surprise of a 50 per cent. bonus in £1 ordinary shares through application of £317,000 of the reserve. The company's ordinary shares had been out of the dividend list since 1916 until six months ago, when an interim dividend of 3 per cent. was paid. The Aron Electricity Meter repeats the 6 per cent. dividend on its ordinary shares, the price of which is 16s. 6d. The newly-issued Electric Finance preference are steady at 1s. 3d. premium, and the Newcastle-on-Tyne new shares attract a good deal of business on the basis of 9d. to 1s. premium. Rubber shares enjoyed a little burst of strength on the Government's announcement that it did not contemplate removal of the Stevenson Restriction scheme. The hopefulness so engendered was chastened by a further fall in the price of rubber to 1s. 4½d. per lb.

Share List of Electrical Companies.

	Nom.	Dividend. 1925.	Dividend. 1926.	Price June 20 1927.	Rise or fall.	Yield. p.c.
Home Electricity Companies.						
Bournemouth and Poole	£1	14	14	59/6	—6d	4 14 1
Brompton Ordinary	1	10	8⅝	25/-	—	5 12 0
Charing Cross Ordinary	1	15	8½	25/6	—	5 12 0
do. do. 4½ Pref.	1	4½	4½	17/6	—	5 2 10
Chelsea	1	12	9⅛	25/-	—	5 12 0
City of London	1	15	10	27/-	—6d.	7 8 2
do. do. 6% Pref.	1	6	6	22/6	—	5 6 8
Clyde Valley	1	8	8	30/6	—	5 5 0
County of London	1	15	7½	28/-	—	5 0 0
do. do. 6% Pref.	1	6	6	22/6	—	5 6 8
Edmundson's Ordinary	1	7	8	29/6	+1/3	5 8 5
do. 7% Pref.	1	6	7	21/-	+6d.	5 16 8
Elec. Supply Corporation	1	10	10	32/-	—	6 5 0
Kensington Ordinary	1	15	8	25/6	+6d.	6 5 6
Lancs. Light and Power	1	7½	7½	26/-	—	5 15 5
London Electric	1	10	8½	24/-	—	5 16 8
do. do. 6% Pref.	5	6	6	5⅛	—	5 6 8
Metropolitan	1	11	6	29/-	—	4 16 7
do. 4½% Pref.	1	4½	4½	17/-	—	5 8 6
Midland Counties	1	5½	6	22/6	—	5 6 8
Newcastle-on-Tyne Ordinary	1	7	5	22/6	—	4 8 6
do. 5% Pref.	1	5	5	17/6	—	5 14 3
do. 7% Pref.	1	7	7	24/6	—	5 14 3
Notting Hill 6% Pref.	10	6	6	10½	+½	5 17 1
North Met. Elec. 6% Pref.	1	6	6	22/-	—	5 9 1
St. James' and Pall Mall	5	17½	8	25/6	—	5 9 10
South London	1	15	8½	25/-	—	5 12 0
South Metropolitan Pref.	1	7	7	1⅛	—	6 3 0
Urban Ordinary	1	7	7	25/-	—	5 12 0
do. 6% Pref.	1	6	6	1⅛	—	5 13 0
Westminster Ordinary	1	15	8½	25/-	—	5 12 0
Whitehall Elec. Invst. 7½% Pref.	1	7½	7½	20/6	—	7 6 4
Yorkshire Elec.	1	8	8	30/-	—	5 6 8
Home Rails.						
Central London Ord. Assented	Stock	4	4	71	—	5 12 8
Metropolitan	,,	5	3	60	—	5 0 0
do. District	,,	3½	3½	63½	—2½	5 10 4
Underground Electric	£1	Nil	1½	18/-	—6d.	1 13 4
do. do. Income	Bonds	6	6	102	—	*5 17 8
Telegraphs and Telephones.						
Anglo-Am. Tel. Pref.	Stock	6	6	101	—	5 19 0
do. Def.	,,	1½	1½	24½	—	6 2 5
Automatic Telephone	1	8	10	47/6	—	4 3 6
Chili Telephone	5	5	6	7⅞	—	3 17 5
Eastern Extension	10	10	10	18⅝	—	*5 6 8
Eastern Tel. Ord.	Stock	10	10	182½	—	*5 9 7
Globe Tel. and T. Ord.	10	10	10	18⅝	—	*5 6 0
do. do. Pref.	10	6	6	11½	—	5 8 1
Great Northern Tel.	10	20	20	28½	—	7 0 4
Indo-European	25	8½	10	45½	—	*5 7 6
Marconi	1	Nil	Nil	1	—¼	... ...
Marconi-Marine	1	7½	8⅝	27/-	—	6 9 8
Oriental Telephone Ord.	1	12	12	53/9xd.	—	*4 9 4
United R. Plate Tel.	5	8	8	9⅝	—	*4 2 1
Western Telegraph	10	10	10	17½xd.	—	*5 14 3
Home and Foreign Trams, &c.						
Anglo-Arg. Trams First Pref.	5	5½	5½	3 7/16xd	—	8 0 0
do. do. 2nd Pref.	5	6	6	3 5/8xd	—	8 8 6
do. do. 5% Deb.	Stock	5	5	72½	+1	6 17 11
British Electric Traction Ord.	,,	8	8	158	+2	5 4 7
do. do. 6% Pref.	,,	6	8	121½	+1	6 11 9
Brazil Traction	100	5	6	167	—8	3 12 0
Brit. Columbia Elec. Rly. Pcc.	Stock	5	5	90½	—	5 11 9
do. do. Preferred	...	6¾	6¾	130xd	—	5 4 2
do. do. Deferred	,,	8	8	155xd	—	*5 3 3
do. do. Deb.	,,	4½	4½	80½	—	5 5 7
London & Sub. Trac. 5% Pref.	1	Nil	Nil	7/9	—	Nil
London United Tram. Deb.	Stock	4	4	59½	—	7 12 5
Mexico Trams, 5% Bonds	—	5	5	81½	—	6 2 8
Mexican Light Common	100	Nil	Nil	43	—	Nil
do. Pref.	100	Nil	Nil	108½	—2	Nil
do. 1st Bonds	—	5	5	73½	—1	6 16 1
Yorkshire (West Riding)	1	5	—	8/9	—	... ...
Manufacturing Companies.						
Babcock & Wilcox	1	12	12	52/6	—	4 19 1
British Aluminium Ord.	1	12½	10	43/-	—	4 13 0
British Elec. Transformer Pref.	1	Nil	7	18/3	—	7 13 6
British Insulated Ord.	1	15	15	67/6	—	4 8 11
Brush Ord.	1	10	10	26/3	—	7 12 4
Callenders	1	15	15	3 7/8	—	4 7 3
do. 6½% Pref.	1	6½	6½	23/9	—	5 9 5
Crompton Ord.	1	Nil	Nil	12/6	—	... ...
Edison-Swan	4/-	10	10	10/	—	4 0 0
do. 5% Deb.	Stock	5	5	85	—	5 17 8
Electric Construction	1	10	7½	26/3xd	—	5 14 3
Enfield Cable Pref.	1	7½	7½	25/6	—	5 17 8
English Electric	1	Nil	Nil	10/-	—	... ...
do. do. Pref.	1	8	—	12/6	—	... ...
Gen. Elec. Pref.	1	6½	6½	23/6xd	—	5 10 8
do. Ord.	1	7½	—	30/6	—	4 18 4
Henley	1	20	25	4¾	—	5 5 3
do. 4½% Pref.	5	4½	4½	4¼	—	5 6 0
India-Rubber	1	5	5	1	—¼	*5 0 0
Johnson & Phillips	1	17½	12½	2½	—	5 0 9
Met.-Vickers Ord.	1	8	8	27/6	—	5 11 4
do. Pref.	2	8	8	2⅜	—	6 14 9
Siemens Ord.	1	7½	7½	27/6	—	5 9 1
Telegraph Construction	12	10	10	20½	—	*4 4 2

* Dividends paid free of Income Tax.

Our Foreign Electrical Trade.

Electrical Exports and Imports during May, 1927.

THERE was a satisfactory rise in our electrical exports during last month, although as regards the individual items, increases and decreases were equal in number. The principal increase occurred in the case of unenumerated electrical machinery, which was over £66,000 above the April total. Insulated wires and cables also improved, to the extent of £51,564, while important rises were recorded for the other two machinery classes—railway and tramway motors and "other" motors and generators. The exports of unumerated electrical goods and apparatus showed the greatest fall; the other decreases, apart from that of £16,222 in submarine cables, were not of very great dimensions. As was to be expected, the comparison with May last year shows a heavy increase. On account of the general strike, the exports during May, 1925, reached a low level, though not so low as it might have been. There was, however, one substantial decrease last month, *i.e.*, the fall of £33,516 in telegraph and telephone instruments and apparatus. A decrease in meters and instruments is also to be noted.

The following figures show the distribution of exported electrical machinery:—

Destination.	May, 1926. £	May, 1927. £	Inc. or dec. £
European countries	58,528	104,870	+46,342
Japan	24,475	21,781	− 2,694
South-American countries ...	25,063	69,806	+44,743
South Africa	54,059	99,884	+45,825
British India	91,457	89,567	− 1,890
Australia	90,430	101,295	+10,865
New Zealand	31,779	30 655	− 1,124
Canada	10,991	34,112	+23,121
Other countries	38,401	55,572	+17,171
Totals	£425,183	£607,542	£182,359

The import section was affected to a greater extent by the general strike, and there was an increase last month in every section as compared with May, 1925, while the total increase was proportionately very large. Unenumerated electrical machinery was the class showing the greatest rise. Comparing the figures with April last, it is seen that unenumerated machinery again led the list of increases. There were only three classes which showed a reduction—unenumerated goods and apparatus, insulated wires and cables, and telegraph and telephone apparatus.

The dwindling tendency shown by re-exports continued during May, although, naturally, they were higher than in the corresponding month of last year.

The totals for the completed portion of the year are of a favourable nature, but the imports have risen in greater proportion than the exports.

	Exports.			Imports.			Re-Exports.		
	Electrical exports for May, 1927.	Inc. or dec. as compared with Apl., 1927.	Inc. or dec. as compared with May, 1926.	Electrical imports for May, 1927.	Inc. or dec. as compared with Apl., 1927.	Inc. or dec. as compared with May, 1926.	Electrical re-exports for May, 1927.	Inc. or dec. as compared with Apl., 1927.	Inc. or dec. as compared with May, 1926.
Electrical goods and apparatus (unenumerated)	£186,433	− £34,413	+ £66,164	£96,579	− £1 199	+ £16 387	£4,224	+ £417	− £43
Insulated wires and cables ...	257,913	+ 51,564	+ 58 675	58,866	− 2 108	+ 36,948	334	− 420	− 421
Glo e lamps	54,211	− 9,369	+ 25,808	21,438	+ 2 077	+ 9 896	1,485	+ 520	+ 1,382
Arc lamps and parts ...	532	− 500	+ 465	4,017	+ 1,777	+ 2,472	51	− 59	− 69
Batteries and accumulators ...	99,828	+ 5,979	+ 36,101	42.593	+ 626	+ 18,080	718	− 8	+ 119
Meters and instruments ...	30,283	+ 825	− 6,052	29,246	+ 9,690	+ 15 098	253	− 470	+ 17
Carbons	1,952	− 129	+ 477	11,153	+ 2,178	+ 3,904	5	+ 142	− 16
Electrical Machinery—									
Electrical machinery (unenumerated	355 061	+ 66,065	+ 111,871	166,935	+ 19,520	+ 85 939	9,024	− 857	+ 6,575
Railway and tramway motors	63 303	+ 27.958	+ 9,534	—	—	—	—	—	—
Other motors and generators...	189,178	+ 42.538	+ 60,954	—	—	—	—	—	—
Switchboards (not telegraph or telephone)	2,902	− 2,061	+ 65	406	+ 406	+ 378	—	—	—
Telegraph and Telephone Cable and Material—									
Telegraph and telephone wires and cable (not submarine)	84.242	+ 18,777	+ 32,773	7 012	+ 2,570	+ 2,686	179	− 1,931	+ 164
Submarine telegraph and telephone cable...	33,422	− 16,222	+ 33,176	—	—	—	—	—	—
Telegraph and telephone instruments and apparatus ...	193,471	− 7,368	− 33,516	27.065	− 1,173	+ 3,898	1,517	− 2,231	− 1,305
Totals	£1,552,731	+ £143.644	+ £394,495	£465,340	+ £35.351	+ £195,686	£17,790	− £5,181	+ £6,403
Increases and decreases for five months of 1927 ...		EXPORTS: + £978,347			IMPORTS: + £381,153			RE-EXPORTS: − £6.344	

Remotely-controlled and Automatic Plant.

Some particulars are given in a recently-issued bulletin of Messrs. Oerlikon, Ltd., of the new hydro-electric generating station which has been erected at Ranconniere, Switzerland, for the supply of power to Le Locle, about two miles away. The plant presents the special feature of being controlled automatically, both on the hydraulic and the electrical sides. Two Oerlikon sets, one 500- and one 350-kVA, are installed, and the station is linked up to the Le Locle distribution station, working either alone or in parallel with the neighbouring system. The generators are synchronous induction machines. The generator regulators and the turbine governors are remotely controlled from the Le Locle distribution station, where a Thury regulator is also provided for automatic pressure regulation. Provision is also made for the automatic closing down of the plant in the event of a fault in the pilot cables, racing of the turbine, too great an overload, or excessive heating of the vital machine parts. Details of an interesting outdoor substation which has lately been erected at Berthoud, Switzerland, by the Bernese Power Supply Co., are also given. It serves to step down the pressure from 45,000 V to about 17,000 V, and at the same time to keep the pressure between given limits by regulation. The plant consists at the present time of one 6,000-kVA transformer-induction regulator equipment; provision has, however, been made for two or three further regulators to be installed at a later date. Both the transformer and induction regulator are of the oil-immersed self-cooled type, the transformer being provided with stacks of cooling tubes, while the induction regulator is in an ordinary corrugated iron tank and is designed for regulating the pressure between 14,400 and 17,600 V; it is operated, under normal conditions, automatically by means of a motor controlled by a quick-acting pressure regulator. The motor is arranged in a separate casing on the side of the regulator. The whole operating gear is enclosed and designed so as to meet the special conditions imposed by outdoor mounting.

South African Electrical Trade.

Figures for 1925 and 1926 Compared.

THE following statement, showing the imports of electrical and similar goods into the Union of South Africa during the year 1926, has been compiled from the recently-issued official trade statistics. The figures for 1925 are added for purposes of comparison, and notes of any increases or decreases are made.

	1925. £	1926. £	Inc. or dec. £
Electrical cable and wire—			
Total	596,000	604,000	+ 8,000
From Great Britain... ...	567,000	554,000	− 13,000
,, United States ...	4,000	5,500	+ 1,500
,, Germany	20,000	41,000	+ 21,000
,, Belgium	2,000	3,000	+ 1,000
Heating and cooking apparatus—			
Total	36,000	69,000	+ 33,000
From Great Britain... ...	24,000	35,000	+ 11,000
,, United States ...	4,000	12,000	+ 8,000
,, Germany	6,000	6,000	—
Meters, electric—			
Total	29,000	34,000	+ 5,000
From Great Britain... ...	21,500	26,000	+ 4,500
,, Germany	5,000	6,000	+ 1,000
,, United States	1,000	1,000	—
Insulators—			
Total	26,000	16,000	− 10,000
From Great Britain... ...	23,000	7,000	− 16,000
,, United States ...	750	6,500	+ 5,750
,, Germany	1,400	1,200	− 200
Electrical material, other—			
Total	33,000	30,000	− 3,000
From Great Britain... ...	20,000	12,000	− 8,000
,, United States ...	7,000	5,500	− 1,500
,, Germany	5,000	4,000	− 1,000
,, Czecho-Slovakia ...	800	—	− 800
,, France	300	4,000	+ 3,700
Electric hand lamps—			
Total	14,000	16,000	+ 2,000
From Great Britain... ...	1,700	2,500	+ 800
,, Germany	2,700	2,500	− 200
,, United States ...	8,000	11,000	+ 3,000
Other electric lamps, globes, bulbs, &c.—			
Total	162,000	141,000	− 21,000
From Great Britain... ...	90,000	80,000	− 10,000
,, Austria	4,000	6,000	+ 2,000
,, Germany	14,000	13,000	− 1,000
,, Holland	33,000	31,000	− 2,000
,, United States ...	16,000	8,000	− 8,000
,, China	3,000	—	− 3,000
Electric lighting outfits, self-contained—			
Total	19,500	25,500	+ 6,000
From Great Britain... ...	2,000	8,000	+ 6,000
,, United States ...	16,000	17,500	+ 1,500
Wireless apparatus and parts—			
Total	102,000	56,000	− 46,000
From Great Britain... ...	84,000	45,000	− 39,000
,, United States ...	7,000	9,000	+ 2,000
,, Germany	4,600	600	− 4,000
,, Denmark	1,700	800	− 900
,, France	1,500	800	− 700
,, Holland	1,600	500	− 1,100
Telegraph and telephone material—			
Total	34,000	62,000	+ 28,000
From Great Britain... ...	16,000	41,000	+ 25,000
,, Sweden	2,000	4,000	+ 2,000
,, United States ...	6,000	4,000	− 2,000
,, Germany	7,600	10,000	+ 2,400
,, Belgium	1,500	3,000	+ 1,500
Batteries, primary—			
Total	22,000	52,000	+ 30,000
From Great Britain... ...	8,000	11,000	+ 3,000
,, United States ...	10,000	31,000	+ 21,000
,, Germany	1,500	3,500	+ 2,000
,, Denmark	1,500	6,500	+ 5,000
Batteries, secondary—			
Total	38,000	60,000	+ 22,000
From Great Britain... ...	8,000	15,500	+ 7,500
,, United States ...	23,000	38,000	+ 15,000
,, Germany	6,000	5,000	− 1,000
Motors—			
Total	146,000	122,000	− 24,000
From Great Britain... ...	102,000	68,000	− 34,000
,, United States ...	17,000	29,000	+ 12,000
,, Germany	16,000	13,000	− 3,000
,, Holland	3,000	7,000	+ 4,000
,, Sweden	5,000	2,500	− 2,500
,, Denmark	2,000	1,500	− 500

	1925. £	1926. £	Inc. or dec. £
Transformers—			
Total	114,000	62,000	− 52,000
From Great Britain... ...	102,000	40,000	− 62,000
,, United States ...	7,000	12,000	+ 5,000
,, Germany	1,000	6,000	+ 5,000
Dynamos and generators—			
Total	70,000	28,000	− 42,000
From Great Britain... ...	64,000	23,000	− 41,000
,, Germany	3,000	2,000	− 1,000
,, United States ...	3,000	3,000	—
Electrical machinery, other—			
Total	789,000	907,000	+118,000
From Great Britain... ...	592,000	687,000	+ 95,000
,, United States ...	83,000	95,000	+ 12,000
,, Germany	64,000	95,000	+ 31,000
,, Sweden	10,000	4,500	− 5,500
,, Canada	16,000	400	− 15,600
Tramway rails and materials—			
Total	50,000	62,000	+ 12,000
From Great Britain... ...	24,000	29,000	+ 5,000
,, United States ...	19,000	23,000	+ 4,000
,, Germany	5,760	9,000	+ 3,240
Tramway rolling-stock—			
Total	12,000	10,000	− 2,000
From Great Britain... ...	6,000	6,000	—
,, United States ...	6,000	4,000	− 2,000
Engines, oil, petrol and spirit—			
Total	47,000	61,000	+ 14,000
From Great Britain... ...	41,000	46,000	+ 5,000
,, United States ...	5,000	12,000	+ 7,000
,, Germany	1,000	700	− 300
,, Sweden	—	1,000	+ 1,000
Engines, steam and gas—			
Total	105,000	50,000	− 55,000
From Great Britain... ...	103,000	49,000	− 54,000
,, United States ...	1,000	1,000	—
,, Germany	600	—	− 600

In addition to the above the following goods were imported as "Government stores":—

Batteries, primary—			
Total	1,500	2,300	+ 800
From Great Britain... ...	1,000	100	− 900
,, Germany	—	600	+ 600
Batteries, secondary—			
Total	2,500	4,800	+ 2,300
From Great Britain... ...	1,000	1,000	—
,, United States ...	400	400	—
,, France	—	3,400	+ 3,400
Heating and cooking apparatus—			
From Great Britain... ...	490	10	− 480
,, United States ...	100	70	− 30
Insulators—			
Total	4,800	6,000	+ 1,200
From Great Britain... ...	4,400	6,000	+ 1,600
,, United States ...	300	—	− 300
Motors and parts—			
Total	1,000	3,000	+ 2,000
From Great Britain... ...	1,000	3,000	+ 2,000
Dynamos and generators—			
Total	6,700	21,000	+ 14,300
From Great Britain... ...	6,000	21,000	+ 15,000
Transformers—			
Total	1,000	400	− 600
From Great Britain... ...	1,000	300	− 700
Electrical cable and wire—			
Total	101,000	87,000	− 14,000
From Great Britain... ...	79,000	60,000	− 19,000
,, United States ...	3,500	3,000	− 500
,, Canada	6,500	500	− 6,000
,, Denmark	10,000	100	− 9,900
,, Germany	500	23,000	+ 22,500
Electrical machinery, other—			
Total	141,000	311,000	+170,000
From Great Britain... ...	133,000	293,000	+160,000
,, United States ...	3,000	14,000	+ 11,000
Telegraph and telephone material—			
Total	190,000	196,000	+ 6,000
From Great Britain... ...	153,000	139,000	− 14,000
,, United States ...	13,000	5,000	− 8,000
,, Sweden	15,000	29,000	+ 14,000
,, Germany	2,000	10,000	+ 8,000

Radio Battery Eliminators.

Appliances for the operation of broadcast radio-telephone receiving apparatus by energy derived from the domestic electricity supply mains.

By P. R. COURSEY, B.Sc., M.I.E.E., and H. ANDREWES, B.Sc., Graduate I.E.E.

(*Abstract of paper read before the* WIRELESS SECTION *of the* INSTITUTION OF ELECTRICAL ENGINEERS.)

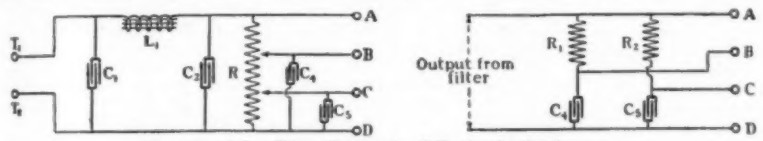
THE modern radio-telephone receiver has to be energised from three distinct sources of sensibly steady direct current, namely :—

(i) High tension, usually between 45 and 150 volts, and a few milliamperes only are generally required; pressures lower than 45 V are sometimes needed, while more than 150 V is called for by some receiving sets, such higher voltages being very desirable in many cases, but only used as a rule when suitable appliances, other than batteries, are available.

(ii) Low tension, 2, 4, or 6 volts, and a current not exceeding from 1.5 to 2 amperes usually suffices.

(iii) Grid bias, up to about 20 volts, and almost infinitesimal current.

Large-capacity by-pass condensers are usually connected across the h.t. and grid-bias supply terminals; they provide a means of reducing the accidental, or unavoidable, coupling between various stages of a multi-valve radio receiver, and the possibility of a higher internal impedance in these appliances renders the presence of these by-pass condensers all the more necessary for stable operation.



Figs. 1 and 2.—Filter Circuits for H.T. Supply Appliances.

H.T. D.C. Appliances.—The essential elements of an appliance for use on a d.c. circuit are sketched in fig. 1, which combination acts as a filter to suppress currents of the higher frequencies: the first condenser C_1 by-passes a proportion of the ripple frequencies, since the reactance of the condenser falls for increasing frequencies; the choke L_1 offers an impedance to these ripples, which increases with the frequency, thus allowing only the lower frequencies to pass through to the second condenser C_2 which offers a further selective action similar to the first condenser C_1. The general form of this filter is of the well-known "low-pass" type.

The full voltage across C_2 is obtained from A and D to which the radio set may be connected; with a 200-240-volt supply at least 200 volts is usually available at these output terminals, the difference being the voltage-drop due to the resistance of the choke. Most radio apparatus, however, requires one or more lower voltages in addition to the full output voltage, which may be obtained by a potentiometer across A D such as is indicated by the resistance R in fig. 1, with the two (or more) tapping points connected to the terminals B and C. It is desirable to connect additional condensers (of at least 1 μF capacity) across the additional voltage tapping points, as shown at C_3 and C_4, to provide additional smoothing, but more important is their action in preventing excessive coupling between valves when more than one valve stage is operated from any one tapping point. If the condensers were omitted the varying anode currents drawn by each valve of the radio receiver would be forced to travel through a portion at least of the resistance R, producing across its terminals a voltage-drop of the same frequency, which would in consequence be communicated to the remaining valves in the receiver. Low-frequency oscillations ("howling") would then be very liable to occur. The low impedance offered by the by-pass condensers C_3 and C_4 to the passage of alternating currents effects a considerable diminution of the voltages available for producing such feed-back effects. It is for this reason also that the capacity of the output condenser C_5 must likewise be large; a minimum capacity of 2 μF is customarily used, but larger values are desirable. A very frequently used arrangement omits the portion of the potentiometer between the tapping point and the h.t. negative terminal D, which modification is shown in fig. 2. This arrangement is simpler and has the additional advantage of somewhat reducing the coupling between different valves, since the total h.t. current is subdivided through different resistance; it results, however, in somewhat greater voltage variation of the tapping points B and C with changes in the load current drawn by the valves.

If a potentiometer arrangement is used, R needs to be high, or it will draw too large a current through the filter. Normally the resistance of the chokes L_1 and L_2 is much in excess of 1,000 ohms, in order to obtain a large inductance in a small space and at a reasonable cost, so that only a few milliamperes can be drawn through the filter without causing excessive voltage-drop. For this reason also the method of fig. 2 is advantageous as it makes a smaller demand upon the filter. Convenient values for R_1 and R_2 are between 10,000 and 100,000 ohms.

H.T. Filter.—With a rectifier, the percentage ripple remaining superimposed on the resulting unidirectional voltage depends upon the output (load) and on the capacity of the smoothing condenser; the larger the condenser the smaller is the ripple voltage.

When, however, a d.c. feeds the filter, the amplitude of the ripple voltage on the system is determined by the generators, &c., on the system, usually of large power capacity, so that the amplitude of the ripple voltage is not very much (if at all) affected by connecting a condenser C_1 across the circuit. The three important factors are :—

(1) The internal resistance of the choke windings as affecting the "regulation" of the apparatus on load.

(2) The resonance, or "pass," frequency of the filter as controlled by the inductance of the choke and the capacity of the condensers, and as affecting its efficiency in removing "hum."

(3) The output impedance of the filter at audio frequencies, as controlled mainly by the capacity of the output condenser of the filter, and as affecting the load which may be drawn from the filter without producing oscillation between the stages of the receiver.

Improvement of all three factors invariably increases the cost of the apparatus. The choke coil and output condenser should be as large as possible, consistent with reasonable cost of the complete appliance, but at the same time the resistance of the choke coil should not be unduly increased to obtain a very high inductance, or the output of the filter will thereby be impaired. Increasing the condenser capacity is therefore of more value than increasing the choke inductance, especially as it also reduces the a.c. impedance of the output circuit. It would appear desirable that the resonant frequency of these two components should be as low as possible, and in any case, if the filter is to be used with an a.c. rectifier, this frequency must be below 50 cycles per second. In order that the filter shall be reasonably efficient at this frequency, its resonant or "pass" frequency should apparently not exceed 25 cycles per second. Some curves show a subsidiary "hump" which might have a serious effect on the efficiency of the filter, particularly if it should occur near 50 or 100 cycles; this possibility emphasises the desirability of plotting the frequency characteristics of any filter that it is proposed to use.

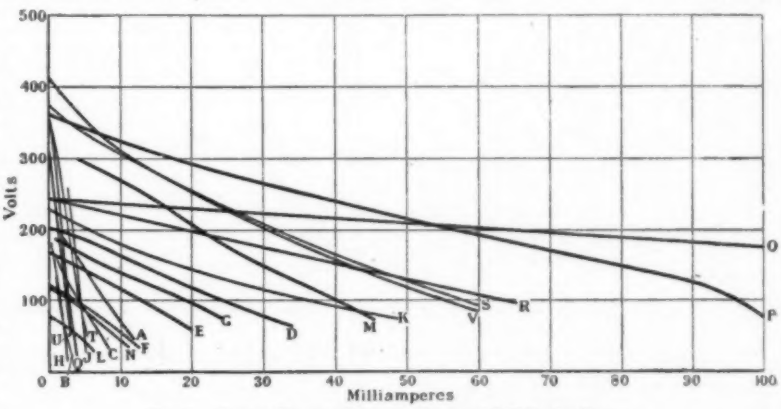


Fig. 3.—Output Characteristics of Commercial H.T. Appliances.

Ripple Voltages.—The magnitude of the a.c. ripple in the output circuit permissible without serious effect upon the

quality of the sounds emitted depends upon the design of the receiver itself. Usually the greatest source of disturbance in the receiver is the detector valve; with a given ripple voltage in the h.t. supply to the receiver the intensity of the hum heard in head-phones used with a single detector valve appears to be very much the same as when one or two low-frequency amplifying stages are added and a loud-speaker is used. Over the usual acoustic range of frequencies it appears that approximately equal disturbance is produced by a given ripple voltage, whatever its frequency may be. The result is also affected by the sensitivity of the telephone or loud-speaker at different frequencies, and by the linearity or otherwise of the output of the amplifier with varying frequency. The above statement is therefore likely to be less true with transformer-coupled than with resistance-capacity-coupled amplifying stages. Satisfactory results may usually be expected if the ripple voltage is of the order of 0.1 volt in the h.t. circuit; even with comparatively weak signals 0.2 volt of ripple is not particularly noticeable, except during silent periods of the transmission.

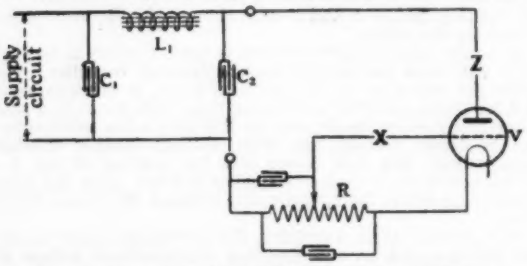


Fig. 4.—Method of Deriving Grid-bias from H T. Appliance.

Rating.—At present there appears to be no definite method of rating these appliances so as to express their output; it is suggested that two or three of the following characteristics might suffice for the purpose:—

(1) The percentage regulation of the output voltage at a stated output current, *e.g.*, 1 mA; this quantity = 100 × voltage-drop at 1 mA output/initial voltage at zero output.

(2) The internal impedance of the appliance expressed in ohms; this quantity = 1,000 × voltage-drop/load current, in mA.

(3) The useful output, expressed in mA for a fixed permitted voltage-drop, say, 33⅓ per cent. from the initial voltage.

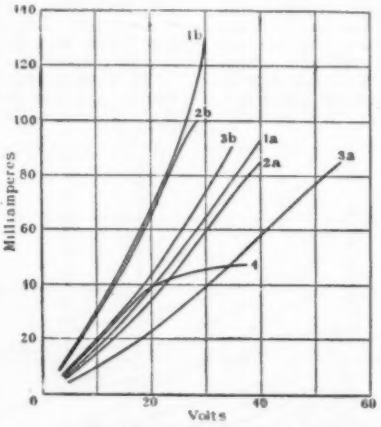
(4) The audio-frequency impedance of the output circuit of the appliance measured at some stated frequency, *e.g.*, 500 cycles per second.

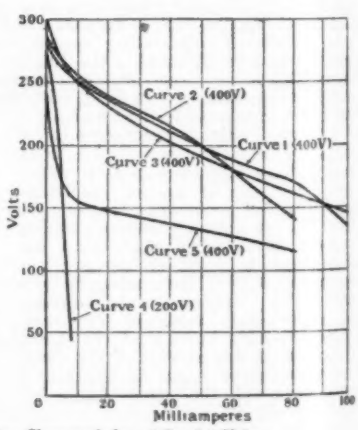
Some idea of the extent of the variation of these quantities for a number of commercial appliances may be obtained from the curves forming fig. 3.

Grid-bias Supply.—A grid-biasing supply from the h.t. appliance itself may be obtained by the insertion of a resistance in series with the negative return lead to the appliance, so that the negative terminal of the supply circuit is more negative than the valve filaments of the radio receiver. A portion of the voltage-drop along the resistance R (fig. 4) can then be used for grid bias, in much the same way as this method has been employed in certain radio receivers and amplifiers to provide the necessary grid bias automatically.

The resistance should be shunted by additional by-pass condensers as shown in the diagram; only one valve V of the receiver is shown and additional grid-bias voltages for other stages in the receiver can be provided if required by additional tapping points on R. The disadvantage of the method is that, since R is in series with the common h.t. supply circuit, if the by-pass condensers shunting it are too small in capacity, there is serious risk of "howling" by reason of inter-stage coupling; the by-pass condensers should preferably be of at least 1 μF each.

H.T. Rectifier Arrangements.—The thermionic valve is customarily utilised as a rectifying means to supply the filter when the appliances are required to operate on a.c. circuits. Any of the more usual types of "receiving valves" may be used for this purpose, preferably by connecting the grid and anode together so as to lower the impedance of the valve; even so, however, the impedance is high enough to account for the limited outputs and poor regulation of some of the eliminators of which the output characteristics are reproduced in fig. 3. Special valves marketed for this particular purpose usually have a low internal impedance to enable them to be used on low-voltage circuits (200-220 volts); for double-wave rectification in the single bulb either two anodes co-operating with a single filament may be used, or two filaments insulated from each other and co-operating with a single anode. In fig. 5 two sets of emission characteristics are plotted, those marked 1a, 2a and 3a being the curves for double-wave rectifiers when only one half is in use (as for single-wave rectification), and are therefore comparable with curve 4, which corresponds to a single-wave rectifier valve; curves 1b, 2b and 3b, show the total emission characteristics of the corresponding valves when both halves are in use.





Figs. 5 and 6.—Emission and Rectification Characteristics of Special Valves.

One or two special valves are now also available in which rectification takes place by means of a species of glow discharge in a rarefied gas; one at least of these functions without any heated cathode and such an arrangement represents a considerable saving in the energy required to operate the complete appliance. Rectification characteristics, including a representative of the above-mentioned special types of valve (curve 5), in addition to those given in fig. 5, are plotted in fig. 6* and represent the output of unidirectional current which can be obtained from them, and the fall in voltage occasioned by increase in the d.c. load current. The internal resistance of these valves varies considerably, not only as between one valve and another, but also in the same valve with different load conditions, the latter being particularly noticeable in the case of curve 5 in fig. 6. It is desirable that the internal resistance should be low, not only in order to improve the regulation and output, but also to reduce the percentage ripple. It is desirable also that the total emission should, in general, be not less than about 100 mA.

L.T. Appliances.—When the available system is direct current, the provision of an l.t. supply to the receiver is comparatively simple, but far from economical, since the current utilised at 4 to 6 volts must be paid for at the supply circuit voltage; the latter may be 250 volts, in which case the efficiency of the arrangement cannot exceed about 2½ per cent., while the remaining 97½ per cent. of the energy taken from the mains must be wasted as heat in the series resistance.

A simple series resistance for heating filaments will produce disturbances in the receiver unless a filter is used, and must be connected to the positive pole of the supply circuit, irrespective of whether or not this is the "live" side; if this is not done, it becomes impossible to obtain the h.t. supply from the same mains circuit. A filter circuit on similar lines to the h.t. filter would be possible, but it would be bulky and costly. In fig. 7 three filtering circuits suitable for l.t. supply are shown; probably the most useful arrangement is provided by a floating battery connected across the l.t. circuit, which is really an adaptation of the shunting resistances, since the batteries merely provide a very low-resistance shunt through which the ripple currents can flow, while the back e.m.f. of the battery prevents unnecessary wastage of energy from the supply circuit. An appropriate series resistance in the supply circuit must be added in a d.c. circuit so as to drop the excess voltage, while for a.c. rectification can be effected at low voltage using a step-down transformer. Even a single floating battery with a simple series resistance provides reasonably effective filtration in most cases, and the resistance should preferably be given such a value that there is a slight balance of current in the direction to charge the battery. The valves used for h.t. supply are in most cases unsuitable for providing sufficient current for the l.t. supply; generally the only available rectifiers are the electrolytic, gas discharge tubes, or solid chemical types, which can provide 1 ampere or over. A true "battery eliminator" has yet to be devised, with the result that the more usually adopted arrangement, particularly for a.c. circuits, is a "trickle charger."

Substitutes.—New valves have recently been developed (patented in 1914) in which the heating of the cathode is effected by means of an internal heating element designed to operate directly off the high-voltage supply mains, or at a low voltage provided by a transformer if the supply is alternating current. Two other solutions of the problem differ markedly from the arrangements so far dealt with; while meeting the requirements to some extent, however, they have disadvantages which have prevented their adoption on any wide scale.

*Curve 4 relates to a single-wave rectifying valve, and is consequently plotted at half the total voltage applied for the other curves. All curves were taken with a smoothing condenser of 8 μ F capacity connected across the d.c. load.

The first entails the use of a special generator driven by any convenient motive power, or by a low-voltage accumulator (provided with smoothing means to reduce the ripple) to provide both h.t. and l.t. supplies to the radio set. The second makes use of thermo-electrically generated voltages, the energy being obtained from any convenient heat source, but the method has not been practically utilised to any appreciable extent.

Precautions.—With many of the commonly used arrangements dealt with there is direct electrical connection between the radio apparatus and the supply mains; precautions must therefore be taken to avoid risk of shock or dangerous short-circuits. The danger of shock is to a great extent exaggerated, but that due to burns, or perhaps fire, may be more serious, chiefly because the supply of energy is maintained from the mains, whereas dry batteries or accumulators would soon be discharged under heavy load conditions.

The main risk of serious short-circuit arises from the fact that most supply circuits are earthed at some point of the system, while an earth connection is also needed by many radio receivers. The insertion of a suitable insulated condenser into the normal earth connection of the radio receiver will not interfere with its normal radio operation, but will obviate any risk of short-circuit; the circuit to which they are connected should of course be properly fused to guard against ordinary insulation failure in the appliance itself. Condensers in the filter circuits, as well as the above-mentioned earthing condenser, should comply with the newly issued British Engineering Standards Specification (No. 271, 1926), when the circuit voltage is in the neighbourhood of 200 volts. When the appliances are used on a.c. circuits, the use of double-wound transformers in the rectifiers should provide adequate protection against short-circuits from the supply mains, provided that the insulation of such transformers is of reasonable quality. The Wiring Rules Committee of the Institution of Electrical Engineers has under consideration a regulation dealing with these matters.

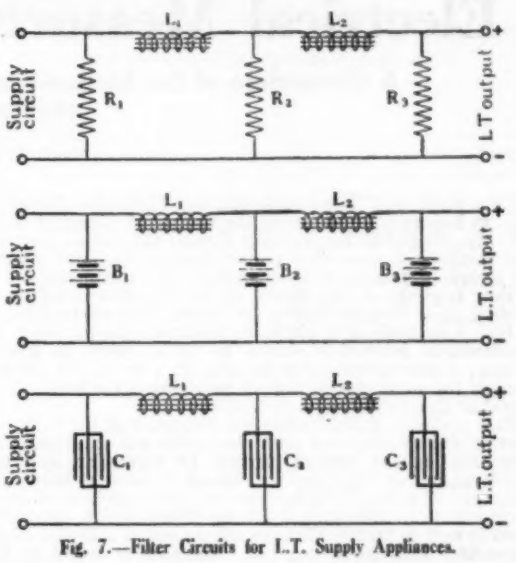


Fig. 7.—Filter Circuits for L.T. Supply Appliances.

Mixed-Pressure Colliery Turbines.

A comparison between the capital outlay and annual cost of high-pressure and mixed-pressure steam turbines for electric power production for colliery use.

(*Review of a paper read before the* ASSOCIATION OF MINING ELECTRICAL ENGINEERS.)

MANY colliery winding engines are steam driven and exhaust freely to the atmosphere. The steam thus exhausted may be utilised to drive a mixed-pressure turbo-generator set for the production of electricity, and under certain conditions this may be a very attractive proposition; in some cases, however, it may be more economical to install a high-pressure turbine and to disregard the low-pressure steam available.

At a recent meeting of the London branch of the Association of Mining Electrical Engineers, Mr. W. F. Bishop (branch president) occupied the chair, when Mr. C. H. Naylor compared the two above-mentioned schemes: assuming a 750-kW turbo-alternator installation, he indicates that the initial cost of h.p. plant will be £10,198 and that a m.p. set will cost £3,178 more; the difference in capital outlay will bear an annual charge of £435.

Assuming that l.p. steam is available for eight hours per day for 300 days per year; coal of 12,000 B.th.u. to cost £1 per ton; a boiler efficiency of 70 per cent.; full-load output for eight hours and half-load for 16 hours per day, if sufficient l.p. steam is available for full load on the turbine, the h.p. set will cost £4,620 per annum, and the yearly saving in favour of the m.p. set will be £1,345. If sufficient l.p. steam is available for only half load, the saving in favour of the m.p. set will not exceed £43. If the winding engines do not operate and it becomes necessary to drive the m.p. set with h.p. steam, there will be a loss against the m.p. set of £1,025.

The figures thus show that it is not worth while installing a m.p. set in preference to a h.p. set if the l.p. steam available is not more than sufficient for half load. However, the author's results are based entirely on his assumed operating conditions, and each case therefore needs to be examined on its merits; his paper is intended to outline a method of doing so.

Discussion in London.

Mr. HUMPHREY M. MORGANS pointed out that the author had said that turbo compressors could be made of a capacity down to 2,000 cu. ft. per minute, and he (Mr. Morgans) wondered if the performance of a compressor of such a capacity would compare with that of a good reciprocating compressor. He also mentioned the effect of placing condensers alongside the turbines instead of beneath them, having in mind a case in which condensers were arranged alongside the turbines, the latter exhausting from the top, a horizontal pipe going to the condensers, and it had been said that by that arrangement nothing had been lost in vacuum, but that a lot had been saved in connection with foundations. Generally speaking, he believed the use of mixed-pressure turbines in this country would decrease: a colliery steam winder which was using unknown quantities of steam offered a good chance for making economies by putting in a mixed-pressure turbine, but if the management turned out the steam winder and put in a high-pressure turbine and an electric winder instead it would do much better in most cases.

Mr. C. H. NAYLOR replied that it was much more convenient to situate the condenser below the turbine, and it was only when there were difficulties in connection with the sinking of foundations, or something of that kind, that the condensers were placed on a level with the turbines. A steam winder having a steam consumption of about 40 lb. per brake h.p. was about the best one could get, and such a winder compared favourably with electric winding for any given colliery, but it did not compare favourably with electric winding in the case of a group of collieries.

Mr. MCSHEA emphasised the importance of considering the effect of back pressure on the primary engine, allowing an extra 5 lb. back pressure in the exhaust main for each engine. On the whole he considered that the effect on the cost of running the primary engine, as the result of putting a mixed-pressure turbine on the end of it, was to increase that cost from 5 to 20 per cent., according to the type of primary engine and the conditions under which it was running; that should be debited against the mixed-pressure turbine. The improvement in the prospects of electric winding made it very doubtful whether the use of the mixed-pressure turbine could be justified at all nowadays, except in purely exceptional cases.

Mr. C. H. NAYLOR replied that the loss was not more than about ½ lb. when a steam accumulator of the gasometer type was used, so that one had not to debit the winding engine very greatly in that case.

Captain A. C. SPARKS (in a written communication) referred to the author's statement that the mixed-pressure set obtained low-pressure steam for nothing; presumably the whole of the cost was transferred to the winders, which appeared to be the only source of low-pressure steam suggested. That appeared hard on the winder, which, in any case, would have a larger steam consumption when working in conjunction with a mixed-pressure set, owing to increased back pressure; he suggested, therefore, that some charge must be made to the mixed-pressure set.

Mr. C. H. NAYLOR pointed out that before a mixed-pressure turbine was installed, the steam was discharged into the atmosphere, but he agreed that back pressure against the winding engines was incurred, and that that should be debited against the mixed-pressure turbine.

Mr. C. H. RODDIS referred to a case in which there had been rapid erosion of turbine blades, which was thought to be due to water, but the erosion ceased when de-aeration plant was installed.

Electrical Measurement of Temperature.

A Comparison of the Thermo-Electric and Resistance Methods of Pyrometry employed in Industry.

By J. HALL, B.Sc. (*Résumé*)

IN a paper on "Thermo-Electric and Resistance Pyrometry in Industry," read before the Society of Chemical Industry, Chemical Engineering Group, the author describes the methods of measuring temperature in industrial practice by means of resistance thermometers and thermocouples. A review is given of the theory of the thermodynamic scale, leading up to its reproduction for the methods referred to. In a typical example of a platinum resistance thermometer, the fundamental interval is shown to be as nearly as possible 1 ohm, a convenient value in ordinary commercial practice, though for work of the highest precision a fundamental interval of about 10 ohms is preferable.

Two methods of eliminating the resistance of the leads connecting the thermometer with the bridge are considered; the compensating-lead method devised by Callendar, and that employed in the "distance thermometer" used at lower temperatures. In the Callendar method a Wheatstone bridge of some sort is necessary, and for workshop use a convenient form is said to be the Whipple self-contained indicator of the Cambridge Instrument Co., Ltd. The scale is drawn so that a change in resistance of 1 ohm in the thermometer circuit shifts the balance-point on the slide wire from 0 deg. C. to 100 deg. C., and thermometers of 1 ohm F.I. are used. The variations in the constant for reasonably pure wire would not be likely to cause a greater error than 2 deg. C. at 1,000 deg. C. or 0.5 deg. C. at 500 deg. C. An ice reading should always be taken before and after using the thermometer for precision work, but there is no necessity for the frequent determinations of the other fixed points. It is necessary in industrial practice to use heavy sheaths, such as a porcelain tube enclosed in an outer iron tube, for the protection of the bulb. An accuracy of ± 1 deg. C. at 100 deg. C. can be attained, it is claimed, on this type of instrument if the indicator has been standardised.

The two-lead "distance thermometer" is usually made direct reading by using the out-of-balance current in the Wheatstone network to give an indication of the resistance, the three arms of the bridge not containing the thermometer remaining fixed. This method involves the adjustment of the battery current to a predetermined value. This type of instrument is not used for such high accuracy as the four-lead types, and is generally confined to fairly low temperatures—up to about 200 deg. C.

In dealing with thermocouple instruments the method of balancing out the additional junctions introduced by the measuring instrument are explained and illustrated.

A comparison is drawn between thermocouple instruments employing a rare metal, usually platinum-rhodium, and those using a base metal. The e.m.f. of the rare metal couple is of the order of 0.01 mV per deg. C., while that of the base metal couples is about five times as great. The advantage of the higher e.m.f. is more than counterbalanced by the fact that the alloys used cannot be made as homogeneous as the platinum alloy. The high e.m.f. of base-metal couples makes possible the employment of relatively robust measuring instruments, and the cheapness of the wires enables heavy-gauge couples to be used. "Hoskins" alloys, marketed in this country by the Foster Instrument Co. and known as chromel and alumel, stand up well against oxidation. The accuracy attainable in the best circumstances likely to be met in works practice with base-metal couples cannot be reckoned better than ± 10 deg. C. at 800-1000 deg. C., and it is not advisable to use base-metal couples for long periods at these high temperatures, though the Hoskins alloys can be calibrated up to 1,300 deg. C. With rare-metal couples, however, ± 3 deg. C. can be obtained with a little care, and temperatures up to nearly 1,600 deg. C. can be measured if it is possible to protect the couple adequately from reducing gases, while 1,400 deg. C. can be regarded as well within the reach of ordinary technical practice. Rare-metal couples are usually made of wire either 0.5 mm. or 0.6 mm. in diameter.

The author describes and compares the potentiometer and galvanometer methods of e.m.f. measurement. The former has the drawback from the industrial point of view of requiring the instrument to be set for each reading, an operation it is desirable to avoid if the observations are to be made by comparatively unskilled workmen.

A brief outline is given of the procedure for obtaining the fixed points where the calibrations are carried out in the works. The freezing points are conveniently observed by melting the metals in tall pots, keeping the surface covered with a layer of powdered graphite. The thermocouple should be protected by a small porcelain or silica sheath.

If the potentiometer is available, the e.m.f.'s at a series of these fixed points may be determined, and the e.m.f.-temperature curve then drawn.

The insulation of the thermo-couples and various constructional details are considered in detail, and in conclusion the author deals with the difficulties of obtaining the thermo-junction at the same temperature as that of the material concerned with. The most difficult problems are in the measurement of a gas flowing in a flue which is at a different temperature. Haslam and Chappell suggest drawing the gas at high speed past the couple inside a radiation shield, in order to put up the rate of heat transfer by conduction.

In an interesting discussion which followed the reading of the paper, it was pointed out that the chemical engineer wanted an instrument which would give an accuracy of ½ deg. at 1,000 deg. C. after the thermo-couple had had to be retrieved from the furnace by its cable. Another necessity called for was constant calibration of thermo-couple instruments in use, because the magnet could never be relied upon to be permanent. It was claimed that although the platinum-rhodium couple might give a greater accuracy than the base metal device, it was certain there would be a larger bill for repairs; for general works use a more robust instrument was desirable, even if the accuracy was out by 20 deg. in 1,000 deg. Where rare-metal couples were used, very great care must be taken to protect them from contamination. It had been found to pay to use rare-metal contacts for the switches.

One speaker emphasised the necessity of getting rid of the prejudice against the use of pyrometric instruments in those works where it had been the practice to rely on rule-of-thumb methods.

From the commercial point of view it was pointed out that one of the first essentials of the instruments was high internal resistance, which was very difficult to get at a low price if the instrument was also to be robust and stand up to workshop conditions. Advice was given to keep away from resistance thermometers because of the frailty of the bulb and the difficulty of obtaining constant voltage from the accumulators. For temperatures from 200 to 2,000 deg. F. it was possible to purchase a base-metal thermo-couple at a comparatively low price, and most manufacturers to-day could guarantee an accuracy of plus or minus 1 deg. The costs of the base-metal and rare-metal couples was in the ratio of 10 to 1 in favour of the former, and, apart from the heavy industries, it was not likely that temperatures above 2,000 deg. F. would have to be measured.

It was further claimed that there were industries in which an accuracy within 50 deg. was good enough, for which base-metal couples were suitable. A nickel-nichrome couple had been used for many years, both for scientific and rough work; it was most excellent and not expensive. The coil in the instrument of the Hoskins Thermo Couple Co. was referred to as of a peculiar metal which apparently it was impossible to solder.

The view was taken that it spoke well for this country that we were in the position we were to-day in regard to such instruments, because America at one time had got a long way ahead of us in the manufacture of instruments for recording temperatures accurately.

Canadian Radio Production in 1926.

The production of all radio apparatus and accessories in Canada during 1926 was valued at $6,277,544, f.o.b. factory, in addition to which furniture manufacturers sold wireless cabinets to the value of $708,658. The details of the production were:—

	1926. $	1925. $
Batteries	2,276,747	2,238,169
Condensers	13,281	41,626
Panels, dials and switches ...	29,895	88,103
Microphones, loud-speakers	146,074	412,556
Transformers	26,855	36,816
Valves	1,261,803	1,299,684
Complete sets	2,253,098	2,667,999
Miscellaneous	269,791	325,675
Total	$6,277,544	$7,110,628

Wireless receiving licences issued during 1926 numbered 207,328, compared with 134,486 in 1925, and broadcasting licences issued rose from 55 to 96. Imports of wireless apparatus from the United States amounted in value to $2,872,991.—*Reuter's Trade Service* (Ottawa).

A New Direct-Current Meter.

An improved type of d.c. motor meter which has recently been introduced has an improved characteristic and several new features of design.

A D.C. mercury motor meter which has recently been developed by MESSRS. FOX & OFFORD, LTD., represents a considerable deviation from the usual design of this class of apparatus, with, it is claimed, corresponding improvement in both its operation and facilities for maintenance.

The Lawson meter, fig. 1, is really the outcome of a number of patents which have been taken out from time to time by Mr. W. Lawson, meter superintendent of the Birmingham Corporation Electricity Supply Department. Fig. 2 shows the meter with the cover removed.

Perhaps the outstanding feature of the apparatus is its greatly improved characteristic curve. Fig. 4 shows an average curve obtained from tests on a dozen of the meters; it will be seen that the overload " droop " is negligible. This improvement is brought about by means of special dampers in the mercury bath, which take the place of the usual compensating coil. There are one fixed and one movable damping vanes. They are placed under the rotor, the " covered " area of which varies according to the disposition of the movable element, which affords a convenient means of regulating the speed of the rotor. An external lever, fig. 3 right, is provided for the necessary adjustment. The fixed portion of the damper covers the bottom slipper, but is insulated from it by means of very fine paper. The damper is secured to the moulding by means of three feet which are embedded in the compound.

Fig. 1.—Lawson Meter.

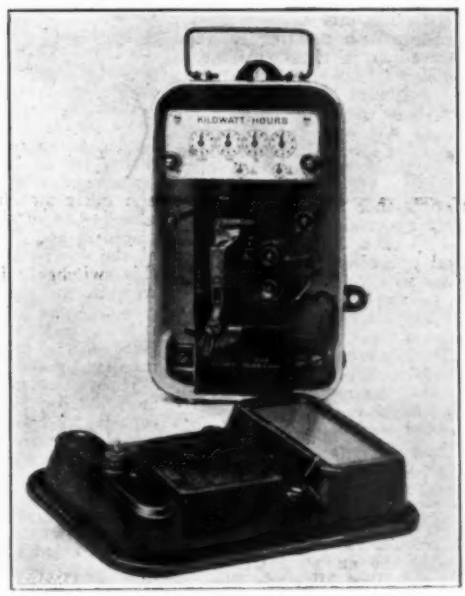


Fig. 2.—Meter Interior.

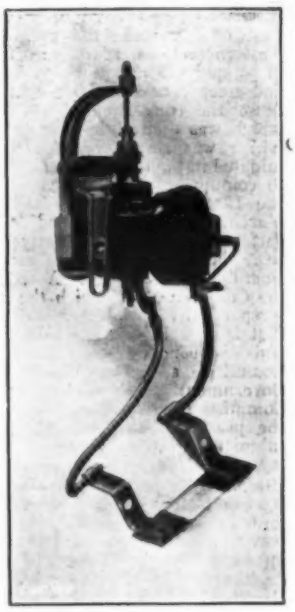


Fig. 3.—Mercury-Bath Unit.

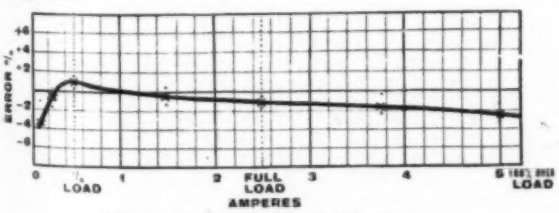


Fig. 4.—"Average" Characteristic Curve.

The mercury bath itself is claimed to be unique. It is made of a bakelite composition, moulded in two parts, and is easily removable as a complete unit, fig. 3, so that repairs can be carried out in the test room. The actual working clearance inside the bath is from 37 to 40 " thousandths." The bath unit is secured to the permanent magnet by means of two thumb screws which, in addition to the terminal screws, are the only ones it is necessary to manipulate in order to remove the unit. For given sizes of meters the bath units are interchangeable.

To render the bath removable entailed a great deal of research which resulted in the provision of special soft-steel slippers moulded into the bakelite. When the unit is put in position the slippers slide between the poles of the magnet and become convenient pole pieces. The design of the bath was only rendered possible by the ability to mould the slippers into the bakelite. It is claimed that the bath is the only moulded one on the market.

As shown in fig. 3, the unit carries both the jewel and the driving pinion, a bracket attached to the moulding carrying the upper or guiding bearing. In connection with the spindle a special sealing device is employed. The upper part of the spindle carries a cone collar which acts as the necessary coupling for the pinion. A special ebonite bush in the top section of the moulding surrounds the spindle. By means of an external lever the bush is raised so that a suitable leather washer in the top is brought into contact with the cone, so locking the spindle and sealing the chamber against leakage of the mercury. The cone is of nickel silver and gives the correct balance to the rotor so that it floats in the mercury. A bakelite filling screw is provided in the top of the bath unit.

As indicated in fig. 3, the larger meters have their shunts soldered directly across the bath leads, so that there is no fear of the shunts getting mixed when interchanging the units. By means of a special tool the shunts are " pinched " for the purpose of calibration.

An unusual and interesting method has been adopted for securing the counter. Two pillar screws project from the interior and are provided with a screwed sleeve and a collar on each. The counter is " dropped " over these sleeves, which can be turned by a large D thumb washer located on the front ends. The adjustment of the position of the counter can therefore be determined with great accuracy and ease. Suitable lock-nuts are, of course, provided.

The permanent magnet lifts out from the case by means of three screws. The whole of the interior of the meter is carried on external bars at the back of the apparatus, and it is on these bars that the meter is hung. The terminals are moulded into ebonite blocks and side-entrance leading-in is provided.

The case is of light sheet-steel and for any size up to 20 A the meter weighs 7¼ lb. By means of suitable feet the meter is arranged to stand upright on the bench—a useful feature in the test room. The meter can at present be made for pressures up to 500 V and loadings up to 150 A.

It is interesting to note that about 5,000 of the meters have been supplied to the Birmingham Corporation, and that some have been on circuit for about 18 months and given very satisfactory results.

Marking Vacuum Cleaners for Denmark.

By a recent Government decision, as from July 1st, all foreign vacuum cleaners imported into Denmark must be marked with their place of origin.

Electricity Supply in the West Midlands.*

By S. T. ALLEN, Chief Engineer and Manager, West-Midlands Joint Electricity Authority.

ONE of the fundamental faults of early legislation was its encouragement of small isolated electricity supply areas, with an almost entire absence of encouragement of co-ordination as between supply authorities and failure to appreciate the necessity of standardisation.

The great war opened our eyes to the position we were drifting into; it showed how essential electric power was to our manufacturing and industrial life, and the importance of the conservation of coal.

In the Midlands, in 1916, a committee of chief electrical engineers was formed to deal with an area embracing the counties of Warwick, Worcester, Stafford, and Salop, and part of Hereford; the area was divided into eastern and western sections, roughly corresponding with the frequencies of supply (25 and 50 periods) prevailing in those portions, and a separate committee was formed for each section. Thus arose the committee of electrical engineers in the district which was then styled the "North-West Midlands District," which was responsible for initiating the work which culminated in the formation of the first Joint Electricity Authority to commence practical operation by itself on the lines of the Electricity (Supply) Act of 1919. This Committee in March, 1918, recommended to a conference representing the various authorised electricity supply undertakers in Staffordshire and Shropshire the setting up of a Joint Electricity Board for the district. A technical committee appointed by the Conference, of which the author was chairman, drew up a report on the subject, which became the basis of the scheme that is now being operated, with little alteration; the report embodies conclusions similar to those of the Coal Conservation Committee and the Williamson Committee appointed by the Government which led to the establishment of the Electricity Commission. The Committee approved the report, and after the passing of the Act of 1919 a scheme was prepared and submitted to the Electricity Commissioners.

An inquiry was held by the Commissioners in February, 1922, as the result of which a new conference was formed representative of electricity supply undertakers south of Stafford, in Staffordshire and Shropshire; a new scheme was prepared, and after a further inquiry in October, 1924, was approved by the Electricity Commissioners, who issued a draft Order in November constituting the amended area an electricity district by the name of the West Midlands Electricity District. A final inquiry was held in December, 1924, and an Order made which was confirmed by Parliament in December, 1925, after nearly 10 years' work on the subject, involving an immense amount of discussion and negotiation.

The area controlled by the Joint Electricity Authority for the West-Midlands Electricity District covers over 1,000 square miles, a very large part of which has no public supply of electricity. The Authority consists of 23 members representative of all the interests concerned. Its first duty was to complete the transfer of the generating stations of the existing authorised undertakers to the Authority on approved terms; the transfer will take place after due notice has been given and when the Authority's technical scheme, interlinking mains, &c., are ready. The whole of the generating stations, land, buildings, and machinery (with the exception of West Bromwich, where the land and buildings will be leased and the machinery purchased) will be transferred to the Authority; the existing owners will retain their main switchboards, which will be used in the future purely as feeder switchboards for the distribution of bulk supplies. The price agreed upon for the transfer is uniform, and is based upon the original cost, less depreciation. The whole of the generation will be carried out under one control, and the electricity required by the existing owners of generating stations will be sold to them at cost. The scheme is a co-operative movement to provide electricity at the lowest possible price—lower than if the existing generating stations continued independent operation—to the whole area.

Given control by one competent large body, it was obvious that single large base-load generating stations with large units of plant and low costs of production could be erected to provide for all future requirements, and the trunk mains interconnecting them with the existing stations would supply also the new districts. Distribution will be carried out by the existing authorised undertakers, except in the areas not hitherto covered, where the Joint Authority will probably be the distributor. Supply will, as far as practicable, be standardised as regards current, frequency and pressure. The standard transmission pressure will be 33,000 V for the primary mains and 11,000 or 6,600 V for the secondary mains.

The following generating stations will be utilised and possibly extended, namely:—Birchills (Walsall), Ocker Hill (Tipton), Black Lake (West Bromwich), and Commercial Road (Wolverhampton); other stations will be utilised for the time being. Immediate provision will have to be made for the erection of a new capital station at Ironbridge, and subsequently a further capital station. Interconnecting lines will also be required during the first stage of development between the above-named stations, as well as bulk supply lines to Shrewsbury and Wellington.

Since the Authority came into being last year it has formed a committee to deal with the technical and engineering aspects of the work, and another to deal with the financial and legal aspects. A building was purchased in Wolverhampton, the centre of the District, which is being adapted for central administrative offices at an estimated cost of £11,000. The Technical Committee commenced work at once, and the author's estimates, covering expenditure of 3½ million pounds, have already been started. Work on the 33,000-V interlinking transmission mains is being pressed on with all speed, and the Birchills and Ocker Hill generating stations are being extended at an estimated cost of £366,000. Orders have been placed for 18 large step-down transformers for the linking-up scheme, and an order for 33,000-V, 500,000-kVA capacity and other switchgear costing about £125,000 has just been placed—one of the largest single orders for switchgear ever placed in and for this country. On account of the high value of the short-circuit currents which have to be allowed for, this switchgear is of a special heavy type, individual units weighing as much as 8½ tons and requiring over 10 h.p. to complete the closing operation. New generator switchgear is being erected at each of the existing generating stations in place of the present generator switchboards, which will be retained by the present owners.

The site of the Ironbridge station is at Buildwas Junction on the River Severn; the station will be designed for a capacity of 160,000 kW, and will be built in sections forming complete connected generating stations. The keynote will be simplicity with commercial efficiency, and the author hopes that by the time the plant is ordered sufficient experience will have been gained to warrant drastic changes in the methods of steam raising and fuel preparation. He hopes that investigations and satisfactory experiments will have so far advanced as to warrant the inclusion of low-temperature carbonisation plant at the Ironbridge station, and provision will be made for the adoption of such plant even if it is not put down in the first instance. He expects that, apart from the necessity of such plant from a national point of view, its use in connection with large power plant will eventually be found to bring about a higher commercial efficiency.

Turning to the Act of 1926 and its relation to Joint Electricity Authorities, the author points out that the Central Electricity Board will not (save under exceptional circumstances) own the generating stations like the West-Midlands Joint Electricity Authority. It may choose one or more of the stations of that Authority to be "selected stations," but cannot give supplies to authorised undertakers in the District without the consent of the West-Midlands Authority. The West-Midlands electricity scheme is not a Government scheme put into operation as a result of the new Act.

If it is shown that there is a demand for electricity supply in any part of the District not already covered, with a reasonable prospect of its being remunerative, the Authority is under obligation to submit proposals for the supply of that area to the Electricity Commissioners; the scheme may include the provision of a main sub-station, main cables, and other sub-stations and distribution mains and services, together with the supply of installations and apparatus to consumers, the provision of local showrooms, &c.

The days have gone by when electricity was considered a luxury for the rich; it is now a necessity for all classes. A supply is being given in thousands of the smallest class of houses in the West-Midlands District, and it is hoped that, having regard to the facilities that will be offered to would-be consumers, there will be such a universal demand for electricity that the prices which it will be possible to charge will benefit the whole district, that existing industries will be greatly improved, and new industries established. A spirit of co-operation and enthusiasm is necessary; petty dissensions must not be allowed to mar the issue. The author hopes that those interested in the gas industry in the area will not make the mistake of opposing electricity supply development, as it will be against their own interests to do so. Experience shows that the gas supplies have steadily increased with the increase of electricity supply. The Authority is considering the possibility of incorporating a low-temperature carbonisation plant in the Ironbridge generating station scheme, which will allow of the production of large quantities of oil, motor spirit, and rich gas, so that it may yet offer the gas concern cheaper supplies of gas and co-operate with it as far as that is concerned.

* Abstract of an informal address delivered to the Chamber of Trade, Wellington, May 24th, 1927.

Electro-Magnetic Couplings.

Some Applications of the Forster Clutch and Generator Drives.

AN interesting feature of many of the new hydro-electric stations in the course of construction in Italy is the use of electro-magnetic clutches for coupling up the turbines and the generators. The design which is being generally adopted is that which has been developed by a Swiss engineer, Herr Paul Forster, two of whose clutches—one designed to transmit 6,000 h.p. at 100 r.p.m. and one for 5,000 h.p. at 85 r.p.m.—have been employed on steel-rolling drives for some time past. It was the success which attended the Forster clutch under the extremely onerous conditions obtaining in rolling-mill driving that led the engineers of the new hydro-electric station at Farneta, near Parma, Italy, to decide to adopt the principle in connection with the driving of their electric generators. Fig. 1 shows a sectional view of the clutch and illustrates its working. A feature of the design is the use of stationary exciting coils, which obviates the necessity for slip-rings and brushes as in the case of electro-magnetic clutches with rotating coils. Some idea of the size of the stationary-coil frame is indicated by fig. 3. A Forster clutch to transmit 17,000 h.p. is stated to weigh under 8 tons and to require for its operation an excitation loading of 2.5 kW, d.c. Non-magnetic iron is used for the double cone and the frictional surfaces are all metallic.

When completed, the plant at the Farneta station will comprise four sets, each of 12,000-kVA capacity, designed to run at respective speeds of 420, 500, 504 and 600 r.p.m. The clutch-operating switch will be mounted close to the turbine starting and stopping mechanism, so that at any time when the load on the station falls off, any one of the turbines can, after de-clutching, be brought to a standstill. The clutches are being designed with a high factor of safety, and will be capable of transmitting a maximum of 17,000 h.p. at 500 r.p.m. When

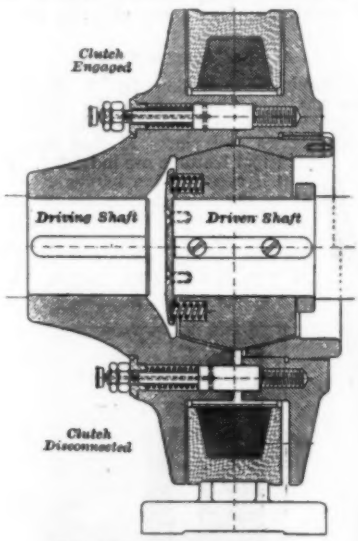


Fig. 1.—Forster Clutch ; Section.

disconnected from their respective turbines the generators will remain connected to the electrical circuit, and will be run as synchronous motors; by suitable adjustment of the field-regulating resistances they will be fed with the wattless current and so utilised as phase adjusters. When it becomes necessary again to use the machines as generators, the turbines will first be started and speeded up to a little more than the normal speed and the clutch then engaged, when, after the necessary adjustment of the turbine inlet valve, and the field regulators, each set will once more resume its normal function of power generation.

Another interesting feature of the new station is that although the four generators are of equal capacity, two are of the ten-pole type, while the others each have twelve poles. This is to allow the station to feed two different distributing systems at different frequencies. The peak loads for the systems occur at different times of the year and by means of a Forster clutch between each pair of alternators, each one can be connected up, with the other one, to the faster or slower turbine, as the case may be, thereby providing additional plant capacity on one of the 42- or 50-cycle systems, as required, without additional plant in the station. The change-over from generator or phase corrector to frequency converter can be effected without operating the main switch.

A similar application of the Forster electro-magnetic clutch can be seen at the recently completed Predaro power station of the Società Ozola of Milan. From the diagram, fig. 2, for which we are indebted to the *Schweizerische Bauzeitung*, it will be seen that the shafts of the two turbines and the generators are all in line with clutches suitably arranged between them, the normal speed being 500 r.p.m. One of the generators is an asynchronous machine and the other synchronous. The former is so constructed that it can be run either as a

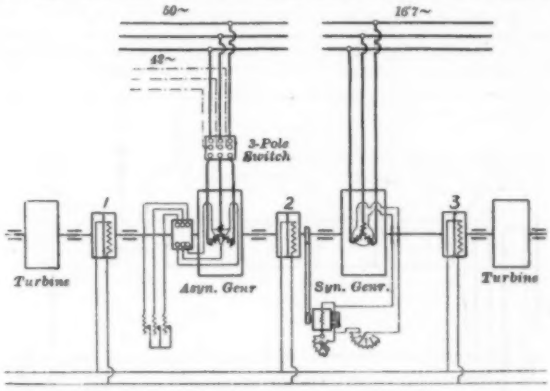


Fig. 2.—Machine Coupling at Predaro Station.

generator or a motor. In addition it has two separate windings—one for ten and one for twelve poles—and at practically a constant speed of from 500 to 504 r.p.m. can be run on or generate either 42- or 50-cycle current. As a motor the machine develops up to 10,000 h.p. and is started by a liquid resistance, by means of which it is also possible to effect a slight adjustment of the speed. The synchronous machine, which has a capacity of 8,500-kVA at 500 r.p.m., is used to generate 16.7-period a.c. for electric-railway operation.

By means of the three clutches, the following combinations of the two turbo-generator sets are possible :—

1. With clutches 1 and 3 engaged and No. 2 disconnected, both sets are generators, one producing either 42- or 50-period current, and the other supplying at 16.7 periods.
2. With clutches Nos. 1 and 3 disconnected and No. 2 engaged, the generators work as frequency converters, feeding from either system and supplying the other.
3. With clutches 1 and 2 engaged and 3 disengaged, both the generators can be driven by the left-hand turbine.
4. The synchronous generating set can be cut out of the railway-supply circuit, when, after disengaging the clutch and stopping the turbine, the generator can be run as a phase corrector.

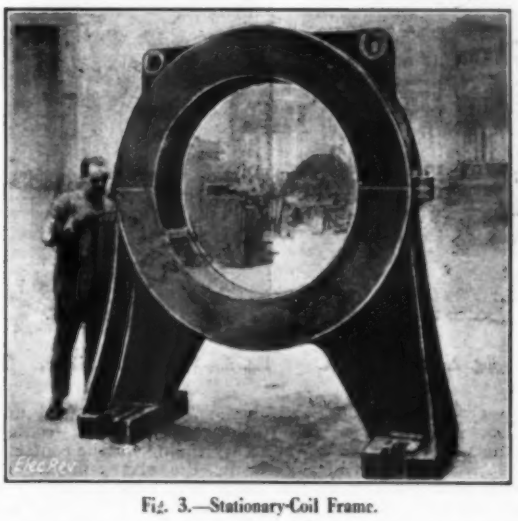


Fig. 3.—Stationary-Coil Frame.

The Forster clutch is also adaptable for use in connection with high-speed steam as well as hydraulically operated plant. An example of this kind is to be seen at the municipal station in Turin, where a steam turbo-generator set which develops 14,500 kVA at 3,000 r.p.m., is coupled up by an easily-dismantled mechanical clutch. When the load on the station is low, the generator is connected by a Forster clutch to an asynchronous motor and used as a phase corrector.

New Electrical Devices, Fittings and Plant.

Readers are invited to submit particulars of new or improved devices and apparatus for publication in this Section.

Non-Pitting Control Apparatus.

A recent development of the DUNDEE ELECTRICAL REPAIRS CO., LTD., Guildhall Works, Erskine Street, Dundee, is a range of starting and control pillars for d.c. motors in which is embodied a patented method of eliminating the burning and pitting of the contacts and brushes usually associated with the short-circuiting type of apparatus. The result is achieved by the introduction of a second short-circuiting brush, which is carried by a common brush arm, but insulated from the main brush. By means of a contactor the auxiliary or leading brush is rendered dead when in the act of making contact with one of the studs, and does not carry the load until full-contact area is established. A second set of contacts is employed to provide the necessary timing for the contactor. Fig. 1 diagrammatically represents the arrangement. The switch arm 4 moves in the usual way over a number of main contacts, cutting out the resistances 10-13. The arm carries both the main and leading brushes, vertical, which are in permanent contact with the fixed horizontal contacts. The contactor 20 is arranged to open and close at predetermined periods by means of the upper timing contacts, which are fed from the main brush circuit. The contacts are so spaced that connection is not made with any of the timing contacts until the leading brush is in full connection with the next stud. The operation of the contactor then puts the two brushes in parallel until full contact is made by the main brush. Fig. 2 shows a starting pillar with the panel slid forward, displaying the apparatus described.

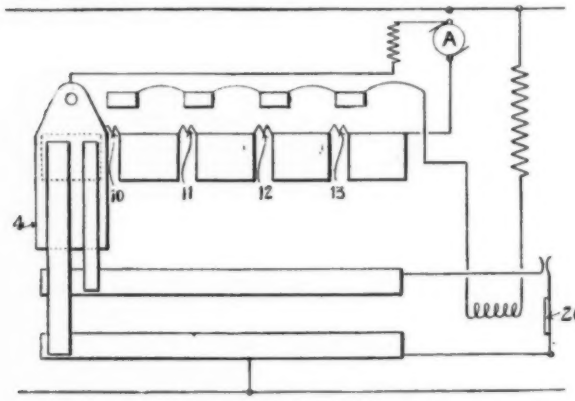


Fig. 1.—Non-Pitting Starter Connections.

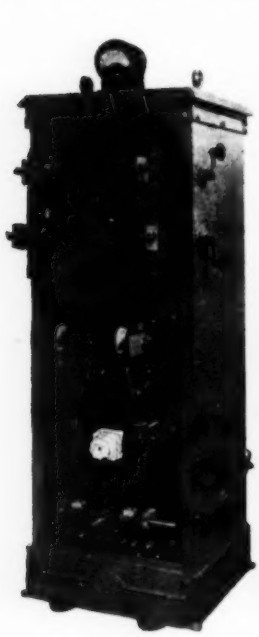


Fig. 2.—Starting Pillar.

Fig. 3.—Type C.T.T.E. Cable.

Fig. 4.—Type C.T.T.D. Cable.

C.T.S. Trailing Cables.

The advantages offered by c.t.s. cable have led to its use under conditions probably more severe than was originally anticipated. In many cases the cable is called on to stand up to severe mechanical compression, due to such occurrences as roof falls, and so on. With a view to providing additional protection to such rough treatment, MESSRS. W. T. HENLEY'S TELEGRAPH WORKS CO., LTD., Holborn Viaduct, London, E.C.1, have designed some special types of c.t.s. cable. In all, five types of multi-core c.t.s. cable are provided. Class C.T.T.A. is the ordinary 3-core type with one insulated earth core. Class C.T.T.B. is similar, but the cores are covered separately with c.t.s., in addition to the usual external sheathing, thereby offering increased resistance to compression of the dielectric between the conductors.

An insulated earthing core is a feature of the next two classes, C.T.T.C. and C.T.T.D. In addition, each core is covered with a supplementary earthing conductor, consisting of a tinned copper braid, which is in contact throughout the whole cable length with the main earthing conductor. The first of the last two mentioned classes is insulated and sheathed similarly to class C.T.T.A., while the latter, fig. 4, has its cores reinforced separately with c.t.s. sheathing, in addition to the external sheathing.

For use in connection with certain protective systems, such as the Williams-Rowley, a further class, C.T.T.E., has been devised. This cable, fig. 3, has an earthing and a pilot core. In addition, a supplementary earthing braid is embedded in the external sheathing. The cores are also reinforced with c.t.s.

A New Theatre Switch.

The accompanying illustration, fig. 5, is of a new s.p. switch which has been designed by the GENERAL ELECTRIC CO., LTD., Magnet House, Kingsway, London, W.C.2, specially for service in theatres and places of that description. The principal features are indicated. The pedestal which supports the handle lever is separate from the contact blocks, and when the circuit is broken is entirely insulated from the current-carrying parts, which are of low current density. Both contacts have a simultaneous quick-break action. Provision is made for front connections so that the terminals are easily renewable.

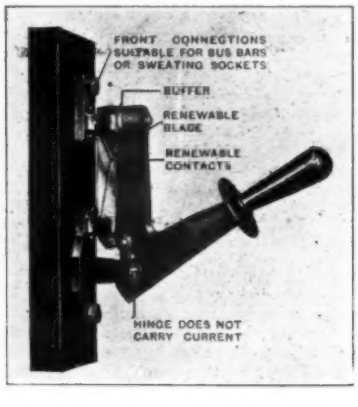


Fig. 5.—Theatre Switch.

A V-Chain Drive.

What is described as Cork's spring-clip transmission chain V belt is a development of MESSRS. CORK'S SPRING CLIP CHAIN BELT CO., Upton Road, Bexleyheath, Kent. It consists of a standard cycle chain, over which spring clips are sprung and secured to the projecting ends of the link pins. Compressed fibre pads are inserted in the sides of the clips, and are tapered at 28 deg. so as to afford a convenient V drive. The result, it is claimed, is a hard compressed belt, free from stretching or slipping. Owing to the increased strength of the chain a smaller "belt" can be used. A clip wrench is employed to remove the clips from the chain, in order to avoid undue side pressure of the pads.

Parliamentary News.

[By Our Special Parliamentary Reporter.]

Re-assembly.

Parliament re-assembled on Monday, June 13th.

"Beam" Communication with South Africa.

On June 14th, Sir W. MITCHELL-THOMSON informed Mr. DAY that the official seven-day test of the beam wireless stations for the Anglo-South African service had not yet begun, but the contractors expected to be able to hand the stations over for the test at an early date.

World Copper Syndicate.

On June 14th, Sir E. CECIL asked the President of the Board of Trade whether his attention had been drawn to the fact that, consequent upon the activities of an international copper syndicate, British manufacturers of finished copper products had been placed at a considerable disadvantage, in the absence of a free market, in purchasing the supplies necessary for their trade requirements; and whether he would consider taking steps to encourage by any practicable means producers of copper in the British Empire, so that this country should not be at the mercy of foreign syndicates for its supplies of copper in the event of any national emergency.

Sir P. CUNLIFFE-LISTER said he was aware that a large proportion of the producers of copper in the United States had formed a company to regulate the sale of raw copper outside that country, and that important European interests were also parties to the arrangement. He was further informed that since the formation of the company the prices quoted to British consumers had frequently been higher than the equivalents of the prices quoted to American consumers. It was clearly of great importance that British users of copper should be able to obtain supplies on terms as favourable as those given to their competitors, and he would welcome the development of copper production and refining within the Empire.

The London Joint Authority Bill.

The House of Commons Committee (presided over by Sir Arthur Shirley Benn) upon the Bill promoted by the London and Home Counties Joint Electricity Authority (the main purpose of which is to obtain power to acquire a site for a large generating station at Duke's Meadows, Chiswick, on the Thames), concluded its consideration of the Bill last week. Among the witnesses called was Mr. J. S. Highfield, past-president of the I.E.E. In the course of his evidence Mr. HIGHFIELD referred to the proposal of the London Power Co., which is now before the Electricity Commissioners, for the erection of another large station at Battersea, and expressed the view that if that station were sanctioned there would be no need for a station at Chiswick. The CHAIRMAN pointed out that the Electricity Commissioners had intimated that there ought to be two stations.

Mr. F. J. WROTTESLEY, K.C. (for the Barnes U.D.C., which was opposing), suggested that the Committee should adjourn until it had learned what decision the Electricity Commissioners had reached with regard to the proposed station at Battersea. The CHAIRMAN said that the Committee wished to proceed with the Bill.

The Committee, at the conclusion of the evidence, found that the preamble of the Bill was proved, subject to the Electricity Commissioners determining that the new station at Chiswick should be a "selected station" under the Central Electricity Board, and subject to the Board's adopting the scheme.

Mr. H. P. MACMILLAN, K.C. (for the London Power Co.), said that the company had to appear before the Commissioners on June 21st, to seek sanction for the erection of the Battersea station. There were many opponents, and he did not want to be prejudiced by any decision of the Committee in this case. He asked for the insertion of a clause in the Bill which would have that effect. The attitude of the Joint Electricity Authority was that the station at Battersea would not be competitive with Chiswick, and, indeed, that both stations were necessary. All he asked was that the *status quo* should be preserved.

The CHAIRMAN said that the Committee had not considered the Battersea station in any way, and did not see why it should attempt to deal with it. They had left the Commissioners to say what stations they wanted, and where they should be erected, having regard to all the circumstances.

The Department of Overseas Trade.

Replying on June 20th to a question by Mr. Hore Belisha, Mr. BALDWIN said that the matter of the abolition or retention of the Department of Overseas Trade was engaging the close attention of the Government, but he was not yet in a position to make a statement on the subject.

County of London Electric Supply Co. Bill.

The County Councils of Surrey and Hertfordshire have announced their intention of opposing this Bill in the House of Lords.

Correspondence.

Correspondents should forward their communications **as early as possible.** *No letter can be published unless we have the writer's name and address in our possession.*

E.h.p. Transmission with 33,000-Volt Cable.

The article by Mr. G. W. Preston in your issue of June 10th is interesting; such articles are very useful in drawing attention to the present delicate nature of 33,000-volt cables. These cables must apparently be handled with such care that only the manufacturers should be allowed to touch them; if they must be run in iron pipes their current rating must be reduced; if they climb a hill, reservoirs of oil to prime them may be necessary, and possibly diaphragm boxes will be required in addition. Where the cables are exposed to the air they must have sunshades. In general it would therefore appear that they require very careful nursing from the time of their manufacture to their being put into service, and results obtained would tend to show that they require this nursing to be continued during their period of service. The types of breakdowns that have occurred on such cables are numerous, and faults have occurred under all conditions of loading. To users of cables and those supplied by them, the nature of the fault and the reason of the breakdown are entirely immaterial, and the frequent breakdowns only show that the cable is not good enough, and is not able to meet the conditions under which it operates.

Possibly they are too cheap (or too inexpensive); certainly their working factor of safety after one or two years is too low. It costs very little more to lay a 33,000-volt than an 11,000-volt cable, yet for the same section, three times the load may be carried more efficiently. On the other hand, a view has been expressed in these columns that a 33,000-volt overhead line is more reliable than the present-day 33,000-volt cables. If this is so, one can only say that these cables are dear at any price.

It is too soon to speak of the performance of the "H" and "S.L." types in this country; an improvement in performance is confidently expected, but the question is, will these cables be as reliable as the old original 6,600-volt cables which have been worked for many years at 11,000 volts?

A. T. Scott.

London, *June 14th*, 1927.

Cheaper Wiring.

I have read the article by "H.W.C." with interest and some misgiving. "H.W.C." is perfectly right in his remarks relative to the home-made laws of certain supply company officials, who in many cases insist on having things done to suit their particular whims and fancies. All contractors will have come up against this kind of thing, and if they have sufficient knowledge of the Acts of Parliament relating to the supply of electricity they will be in a position to put the "know-alls" in their proper place. I, however, will not advocate cheaper wiring, as this cheapness is at present to the detriment of the contracting industry. I certainly would never dream of fitting four or five heating sockets, looping them together with 3/.036 or 7/.029 cable, and connecting them to one circuit. This arrangement may be all right for an electrical engineer's own house, as this gentleman would know the carrying capacity of his cable and how to use his apparatus. For anyone else, however, the job would (in my opinion) be indeed a shoddy one. Far too much cheap wiring is being done and seems even to be encouraged by some supply authorities, who should deprecate such work. It is not our policy as respectable contractors to encourage cheaper wiring; rather let us say better wiring, and uphold the status of the contracting industry. If anyone can suggest a method of attaining this object I shall be pleased to give any help that lies in my power. I will anticipate anyone suggesting the E.C.A. as a possible solution and would state that in this area (in my opinion) this body is more a hindrance than a help to really good contractors.

A. Milne.

Glasgow, *June 16th*, 1927.

Metal-clad Draw-out Switchgear.

Mr. Davies, in his letter on the above subject in your last issue, infers that the advocates of vertical metal-clad switchgear have had no opportunity of witnessing circuit-breaker interrupting-capacity tests. I would like to inform him that they have not only witnessed tests on their own breakers with equivalent plant to that which he refers to, but have also seen kinematograph films showing the performance of various sizes of horizontal metal-clad units when the breakers are tested to destruction. These have in no way modified their view as to the superiority of the vertical principle, and have given the lie to the speculation that the busbars on horizontal gear are immune from trouble in the event of a breaker failure. The breaker referred to in his letter can scarcely be called "reasonably flameproof" when such a cloud of flame resulted, and either horizontal or vertical bars would have been enveloped in such a case. The performance, however, indicates the necessity for revision in that particular design. That circuit breakers can be con-

structed without such an emission is evidenced by the fact that the latest A.I.E.E. rules state: "The breaker shall perform at or within its own interrupting rating without emitting flame." It is a matter of design, location, and type of venting, and there is no reason why one type should not be as immune from trouble from this cause as another. It is significant that the largest switchgear manufacturers in the world, who were the first to have experience with a large plant for interrupting-capacity tests, have already supplied vertical drop-down gear for a power station designed for a half-million kW of plant.

Mr. Davies also criticises the double-breaker system of busbar selection as incorporated so simply in the vertical type of gear. I wish to point out that this system has not only stood the test of several years' operating duty on all pressures up to 33 kV, but has successfully withstood severe tests designed to prove its efficiency. A standard double breaker in one tank had its busbar terminals connected to two independent 33-kV supplies, and one breaker was put through rupturing-capacity tests whilst the other remained open. Before the tests the engineers, who had had long experience with the testing plant, predicted that there would be no danger of the trouble spreading from the breaker undergoing tests to the auxiliary busbar terminals. Their prediction was fully confirmed by the tests. Furthermore, the contacts of the breaker which had not been in service were not in any way damaged, and the second breaker was thoroughly fit for service.

It is not for one moment claimed that the double breaker in one tank is as good as two breakers each in separate tanks; this would, of course, be more costly, and take up more space. It is, however, contended that the arrangement provides a safe and convenient method of bus selection, enabling the facilities which duplicate bars afford to be taken advantage of, whilst at the same time providing a spare breaker which can be used in case there is not enough time to inspect the contacts after operation on a fault.

The "novel ideas" Mr. Davies refers to were introduced by my company to eliminate the weaknesses of the old designs and to provide the facilities which modern requirements demand. Happily these are now backed up not only by service experience, but also by special tests designed to prove their efficiency. In view of this controversy I have obtained permission to publish the enclosed letter from the Manchester Corporation Electricity Department which was received in 1925, and the letter may be of interest to your readers.

S. Ferguson.

Manchester, *June 18th*, 1927.

[Enclosure.]

Manchester Corporation Electricity Department,
Dickinson Street, Manchester,
November 6th, 1925.

Subject: 33 and 6.6-kV Switchgear—Dickinson Street Sub-Station.

Messrs. Ferguson, Pailin, Ltd.,
Higher Openshaw, Manchester.

Dear Sirs.—In reply to Mr. Ferguson's inquiry concerning our experience with the operation of the double switch unit type of switchgear installed at the Dickinson Street substation, I am pleased to say that, so far, it has proved highly satisfactory, and provides the degree of flexibility necessary at that station.

Both sets of busbars are in operation, and two separate ring main systems pass through the 33-kV bars, whilst on the 6.6-kV side one bus-bar is connected with the Barton supply, and the other to Bloom Street or Stuart Street, as the case may be.

Work has been carried out on one set of bars on the 33-kV system, with the other set in service, but, of course, every precaution was taken to prevent any mistake in operation during the time the work was in progress.

Yours faithfully,

H. C. LAMB,
Chief Engineer and Manager.

Legal.

Le Breton Engineering Co. v. Norton Wireless Co., Ltd.

IN the Shoreditch County Court, on June 14th, before Judge Cluer, Mr. W. Le Breton, trading as the Le Breton Engineering Co., St. John's Wood, N.W., sued the Norton Wireless Co., Ltd., to recover £72 18s., the price of 7½ gross of variable gridleaks which the defendants were said to have ordered and refused to take.

For the plaintiff it was stated that the order was a verbal one given to an agent. It was for 15 gross, and half had been delivered and accepted. Mr. KELLY, for the defendants, admitted giving an order for 7½ gross, but said that he had never seen the agent which it had been alleged took the order for 15 gross.

Judge CLUER said that the alleged order should have been confirmed by the plaintiff. He accepted the defendants' version and gave judgment for them with costs.

Reviews.

The Atomic Theory. By Prof. ARTHUR HAAS; translated by T. VERSCHOYLE. Pp. xiv + 222; figs. 56. London: Constable & Co., Ltd. Price, 10s. 6d. net.

The author of this book is professor of physics in the University of Vienna, and the work here translated, which is practically identical with Part III (of Volume II) of his "Introduction to Theoretical Physics," grew up out of the lectures which he delivered at the University of Vienna in the exercise of his profession. Two years having elapsed since the appearance of the German book, it has been necessary for Professor Haas to make sundry corrections and to supply some further additions, in order that the English edition may be well up to date. The rate of progress in the advance of this branch of science is at present so great, that a book begins to become obsolete from the very date of its publication; and readers interested in the subject, and wishing to keep themselves well informed, have constantly to be buying new books if they are not to fall behind in their knowledge. It is therefore particularly needful, in noticing books on this subject, to indicate clearly the nature and scope of its contents, so that readers may not find themselves purchasers of too many books that they find to be of little service to them.

The object of the work before us is to explain fully the fundamental ideas involved in modern atomic theory and set out the most important consequences that ensue therefrom, so far as this can be done without introducing the higher mathematics, or presuming any deeper knowledge of the science of physics than is comprised in the ordinary school curriculum. The book is therefore designed to be of assistance to all persons of scientific education, and the author believes all workers in allied branches of science, such as chemistry, will find it adapted to their needs. Professor Haas has a clear mind himself and a gift for making things clear to his readers. It would be difficult to name a work of this size in which the material dealt with was better handled. The first chapter deals with the elementary quanta: here the facts on which the present theory was built up are concisely and admirably marshalled. In the next chapter the theory of the hydrogen atom is set out with the same lucidity. Chapter III is devoted to röntgen rays, and Chapter IV to the theory of the elements. On this foundation, the general theory of spectra and of atomic structure can then be firmly established, and this is done in the fifth and last chapter. The valuable contents of the book however do not end here, many useful pages follow by way of an appendix. First a summary of the contents of each chapter is very helpful in gaining a comprehensive view of the several departments of the subject. Then a synopsis of the symbols most frequently used. This feature might with advantage be imitated by all writers, as it saves one who consults the book hurriedly, much turning over of pages. The same might be said of the table of the universal constants in atomic physics which follows. Finally there is an historical summary valuable for rapid reference, which serves to impress—indeed, it almost stuns—the mind with a sense of the prodigious rate at which knowledge is now being accumulated. A well designed index concludes a work which, in 220 pages, ably covers the whole range of the subject. In spite of the necessity for so much compression the book is eminently readable, thanks to wise selection of material and the excellence of its arrangement.

Rotary Convertors: Their Principles, Construction and Operation. By E. P. HILL. Pp. xiii+329; figs. 247. London: Chapman & Hall, Ltd. Price, 25s. net.

Although the "British Standard Glossary of Terms used in Electrical Engineering" (B.E.S.A. Report No. 205) enjoins us to adopt the American name "Synchronous Convertor"—a point with which we do not quarrel—we still like to think that this type of machine, at least for 50-cycle frequency, was developed and perfected by British designers. It has always appeared to us that the 25-cycle compromise, with its costly consequences under the new Electricity Act, was one of the least desirable engineering developments ever imported into this country.

The future of the rotary convertor furnishes matter for interesting speculation. With the rather rapid conversion from direct to alternating current for distribution it would seem that the relative importance of this type of machine is likely to diminish.

A feature that has doubtless proved attractive to many writers—though perhaps unconsciously—is the remarkable ease of deducing many facts concerning the action of the rotary convertor by the aid of elementary mathematics, and also the simplicity of the results thus obtained.

Though written by a designer, the book before us is not intended for designers, but for engineers responsible for purchasing, operating, or testing rotary convertor machinery. This fact largely explains the character of the book, but to our mind does not justify the use of so many general arrangements and photographic reproductions throughout the text. The book is beautifully got up, and the illustrations as a whole are excellent; but we think that money and space could have been saved with advantage by the omission of numerous photographs and other material. Fortunately, the book has not

been spoiled in this way, for there is much solid material which will achieve the intended purpose.

Turning now to the contents of the book, the reader will appreciate information on many points associated with the working of rotary convertors, in addition to much of what might be classed as standard information. In considering armature heating, it is satisfactory to note that the maximum conductor heating is discussed. Though this does not enable the maximum temperature rise to be accurately predicted, owing to the flow of heat, it does provide a means of estimating the output obtainable under given conditions. Among the constructional features dealt with, the question of the brush angle is argued at length. In view of the fact that the rotary convertor is the chief culprit in the interference with communication circuits, we should have preferred a much more detailed treatment of this discussion. Also the effect of saturated iron in transformers employed in connection with reactance control of the voltage might well have been dealt with at greater length.

There is a useful chapter on transformers and auxiliary apparatus. An interesting section on the origin of the triple harmonic is included. In the general treatment of this subject much yet remains to be done. The starting of convertors then follows, and many important details in this connection are emphasised. Though the author is on the staff of Messrs. Metropolitan-Vickers Electrical Co., justice is done to the methods used by other firms.

The remaining chapters deal with operation, control, specifications, and testing, but we think enough has been said to show that the book will be of great service to those requiring a good general knowledge of rotary convertor practice. The book concludes with a four-page bibliography and an index.

Published Specifications.

Compiled expressly for this journal by a firm of Chartered Patent Agents. The numbers in parentheses are those under which the specifications will be printed and abridged, and all subsequent proceedings will be taken.

1926.

1,961. "Electrical control gear for the starting of electric converting apparatus." M. W. Woods, M. G. Woods, J. P. Keith, J. Cruwys, G. Richardson and Power Equipment Co., Ltd. January 22nd, 1926. (Cognate application 9,931/26.) (271,534.)

2,178. "Ignition magnetos." E. C. R. Marks (Wico Electric Co.). January 25th, 1926. (271,536.)

4,459. "Electric selective distant control systems." Standard Telephones and Cables Ltd. (Western Electric Co. Inc.). February 16th, 1926. (271,544.)

4,766. "Electric switches." H. D. Jackson Buckle Co., Ltd., H. D. Jackson, and F. White. February 19th, 1926. (271,547.)

5,286. "Vacuum electric tube devices." T. W. Lowden. February 24th, 1926. (271,558.)

7,318. "Electric organ action." J. Swinburne. February 25th, 1926. (271,560.)

5,390. "Antenna systems." British Thomson-Houston Co., Ltd. May 9th, 1925. (251,946.)

5,391. "Telephone systems." Standard Telephones & Cables, Ltd. (Western Electric Co. Inc.). February 27th, 1926. (271,576.)

5,393. "Wireless receiving aerial systems and circuits therefor." G. A. Mathieu. February 27th, 1926. (271,577.)

5,618. "Impulse transmitters for use in telephone or like systems." Automatic Telephone Manufacturing Co., Ltd. June 1st, 1925. (252,674.)

6,133. "Electric generator or gas battery." C. H. Kendall (legal representative of J. A. Kendall, deceased) and R. E. Gore. March 4th, 1926. (271,581.)

6,381. "Terminal binding-posts for electric conductors." Oliver Pell Control, Ltd., and C. Oliver. March 8th, 1926. (271,583.)

6,483. "Vacuum electric tube devices." E. Y. Robinson, E. J. E. Hubbard and Metropolitan-Vickers Electrical Co., Ltd. March 8th, 1926. (271,584.)

7,146. "Magneto-electric machines." British Thomson-Houston Co., Ltd., and A. P. Young. March 15th, 1926. (271,592.)

7,354. "Construction of electric transformers." English Electric Co., Ltd., and A. T. Chadwick. March 17th, 1926. (271,594.)

7,431. "Means for the electrodeposition of chromium and its alloys." Clausson & Co. Aktiebolag. January 14th, 1926. (264,442.)

7,840. "Electrical resistance heaters for low temperatures." J. G. A. Rhodin and E. B. Westman, Ltd. March 22nd, 1926. (271,600.)

8,450. "Electric discharge tubes." M-O Valve Co., Ltd., and C. W. Cosgrove. March 29th, 1926. (271,603.)

8,877. "Telephonic instruments." W. J. Rickets. April 1st, 1926. (271,604.)

9,728. "Cone-type loud speaker." Hopkins Corporation. June 1st, 1925. (252,685.)

9,733. "Loud speakers." Hopkins Corporation. December 22nd, 1925. (263,478.)

10,128. "Cable grips." Callender's Cable & Construction Co., Ltd., and P. T. Wood. April 17th, 1926. (271,613.)

10,895. "Thermal-relay or time-lag device for use with electrical circuits." F. Brotherton. April 26th, 1926. (271,618.)

11,069. "Violet-ray high frequency apparatus." G. H. L. Beagley. April 27th, 1926. (271,620.)

11,303. "Means for maintaining constant the speed of electrical motors." E. E. Tasker. April 28th, 1926. (271,622.)

11,672. "Contact-breakers for magneto-electric ignition apparatus for internal-combustion motors." A. Lindberg. May 3rd, 1926. (271,627.)

11,477. "Dynamo-electric machines." Maschinenfabrik Esslingen. May 28th, 1925. (252,731.)

13,865. "Dynamo-electric machines." Maschinenfabrik Esslingen. June 2nd, 1925. (Addition to 252,731.) (253,115.)

15,294. "Automatic lighting device for quartz mercury-vapour lamps." J. Brettmon. June 17th, 1925. (253,927.)

16,524. "Electric and gas lamp shades." G. F. Green. July 1st, 1926. (271,665.)

19,265. "Electrolytic apparatus and electrodes therefor." W. G. Allan. August 4th, 1926. (271,685.)

20,054. "Process of and apparatus for joining cables." Siemens-Schuckertwerke Ges. and F. Hanff. August 13th, 1926. (271,688.)

22,679. "Franking machines." U. Kohler and Hasler Akt. Ges. vorm. Telegraphen-Werkstatte Von. G. Hasler. September 14th, 1925. (258,300)

22,784. "Electrical connection and method of forming the same." National Carbon Co. Inc. March 3rd, 1926. (267,081.)

24,197. "Electric machines with slot winding." Siemens-Schuckertwerke Ges. October 1st, 1925. (Addition to 234,821.) (259,228.)

24,296. "Draw-out trucks for electric switchboards." Johnson & Phillips, Ltd., and P. M. Wood. October 1st, 1926. (271,705.)

24,354. "Method and means for converting mechanical vibrations into acoustical vibrations." Gramophone Co., Ltd. May 1st, 1926. (270,238.)

24,689. "Electrical accessories for the internal-combustion engines of motor vehicles." Soc. de Paris et du Rhone. November 4th, 1925. (260,983.)

24,717. "Wireless receiving apparatus for the elimination of atmospheric disturbances." E. Geles. October 5th, 1925. (259,255.)

25,067. "Electrical condensers." Dubilier Condenser Co. (1925), Ltd. February 26th, 1926. (266,668.)

25,934. "Rotary distributors for electric machines." J. G. Daloz. October 20th, 1925. (260,255.)

26,308. "Electric condenser terminal arrangements." Dubilier Condenser Co. (1925), Ltd. April 29th, 1926. (270,241.)

26,646. "Process of electrolytically sterilising water and apparatus therefor." P. M. R. Salles. October 25th, 1926. (271,721.)

26,809. "Means for producing high vacuum." British Thomson-Houston Co., Ltd. November 27th, 1925. (262,069.)

26,895. "Electrolytic apparatus and electrodes therefor." J. P. Scott. October 27th, 1926. (271,726.)

27,306. "Connections for electric circuits." G. F. Judd and E. A. Millington. November 1st, 1926. (271,730.)

27,474. "Carbon slip-pieces for current bow collectors." E. Conradty and O. Conradty. November 23rd, 1925. (261,730.)

27,581. "Electrical direction indicator for vehicles." G. Bruckner. November 3rd, 1926. (271,731.)

28,557. "Electric furnaces." Sir W. G. Armstrong, Whitworth & Co., Ltd., and E. Windle. November 12th, 1926. (271,739.)

28,769. "Gaseous electric conduction apparatus." Ratheon Manufacturing Co. December 21st, 1925. (263,108.)

28,904. "Starters for engines." M. B. Jackson. March 17th, 1926. (267,884.)

30,156. "Ships' telegraphs." J. M. Rutherford. November 29th, 1926. (271,750.)

30,342. "Means for packing electric and like bulbs." J. Brownlie and G. M. Woodhouse. November 30th, 1926. (271,753.)

30,336. "Magnetisable material." E. Gumlich. November 30th, 1925. (262,153.)

30,437. "Time-switching control apparatus for electric current-consuming apparatus." Siemens-Schuckertwerke Ges. December 2nd, 1925. (262,435.)

1927.

1,701. "Electric furnaces for heating gases to high temperatures." Akt. Ges. Brown, Boveri et Cie. January 22nd, 1926. (264,849.)

1,881. "Electric arc lamps." L. Korsten. February 25th, 1926. (266,685.)

3,348. "Ventilation of electrical machines." Allgemeine Elektricitats-Ges. February 6th, 1926. (265,619.)

3,988. "Electric welding torches." British Thomson-Houston Co., Ltd. February 20th, 1926. (266,336.)

5,627. "Commutator motors or generators with switching arrangements for the rotor winding." C. Lotte. March 12th, 1926. (Addition to 242,602.) (267,492.)

5,790. "Artificial lighting system combined with lamp reflectors or lamp shades for artificially lighting public streets or thoroughfares" J. Dollard. March 2nd, 1927. (271,789.)

6,430. "Electrode holders for arc lamps." J. R. Qualn. January 25th, 1926. (Divided application on 266,872.) (271,791.)

Trade Mark Applications.

THE following are among the recent applications for British trade marks. Objections against any of the proposed marks may be lodged within one month from the dates given :—

June 8th.

Welradco. No. 479,021. Class 8. Instruments and apparatus for use in wireless telegraphy and telephony.—Wooldridge Radio Co., Ltd., 19, Lisle Street, W.1.

Brunet. No. 479,214. Class 8. Electric transformers, loud speakers, and headphones.—Pettigrew & Merriman (1925), Ltd., 2 & 4, Bucknall Street, W.C.2.

Aurion. No. 480,162. Class 11. Apparatus for the use of deaf persons.—Lawrence & Mayo, Ltd., 19, New Oxford Street, W.C.1.

Electrolux. No. 469,787. Class 50. Refrigerating chests, safes, and goods of a like kind.—Electrolux, Ltd., 153 & 155, Regent Street, W.1.

Glypanite. No. 479,395. Class 50. Electrical insulating material.—Micanite and Insulators Co., Ltd., Empire Works, Blackhorse Lane, Walthamstow, E.17.

Himegite. No. 480,463. Class 50. Insulating substances (electrical).—T. De la Rue & Co., Ltd., 110, Bunhill Row, E.C.1.

June 15th.

Touchtone. No. 472,904. Class 8. Wireless telephonic receivers, but not including accumulators or any goods of a like kind.—Gent & Co., Ltd., Faraday Works, St. Saviour's Road East, Leicester.

Liontron. No. 479,444. Class 8. Crystal detectors.—S. Lyons, 119, Clerkenwell Road, E.C.1.

Walbro, W.B. (lettering and design). No. 479,739. Class 8. Wireless telephonic apparatus and instruments.—Walker Bros., St. Joseph's Works, High Street, Bramley, Guildford.

Synchronola. No. 479,893. Class 8. Wireless telephonic apparatus and parts.—Synchronola Radio Co., Ltd., 150, Brownlow Road, Horwich, Lancs.

Davent. No. 480,759. Class 8. Electric batteries.—M. Wright (Midland Electrical Co.), 113, Coleshill Street, Birmingham.

Stella Electric Lamps (lettering and design). No. 479,034. Class 13. Electric lamps of ordinary metal made in Great Britain.—Stella Lamp Co., Ltd.

Mainten. No. 479,588. Class 8. Philosophical instruments, scientific instruments, and apparatus for useful purposes; instruments and apparatus for teaching, but not including thermostats or any goods of a like kind.—H. R. Malby (Radio & Electrical Installations), 126, Portland Road, Hove.

Medicoil, No. 479,542, and Sunviray, No. 479,543. Class 11. Instruments, apparatus and contrivances for surgical or curative purposes.—Ajax, Ltd., 117, Central Street, E.C.1.

New Work for Contractors.

Particulars of new works and building schemes for the use of electrical installation contractors in search of work and all interested in the sale of electrical and allied plant and other products.

Publication in this list is no guarantee that electrical work is definitely included. Alleged inaccuracies should be reported to the Editors.

ALFRETON (DERBYSHIRE).—Primitive Methodist church, school, &c. (£30,000); R. Watchorn (donor).

ASHFORD (KENT).—Nurses' home, for East Ashford Board of Guardians; E. A. Jackson, architect, 13, North Street.

BARNSLEY.—School, Ardsley, for the borough E.C.; Dyson, Cawthorne & Coles, architects, 10, Regent Street.

BRADFORD.—Seven-storey block, offices and shops (£230,000); city architect, Town Hall. Mental hospital, Westwood estate (£260,000); city architect. Filter pressure house, Bingley; Thos. Obank & Son. Police headquarters; city architect.

BRISTOL.—Reconstruction of Palace Picture Theatre; G. H. Blackburn, manager; F. Verity, architect, London. Cinema on site of St. George's Hall, for J. Pugsley; W. H. Watkins, architect, Clare Street. Institution for mental defectives, for the T.C.; borough engineer. Doubling railway at Avonmouth Docks; city engineer.

CARLISLE.—Additional 300 houses, for the T.C.; borough surveyor. Warehouse, Caldergate; J. Leslie, architect. Stores, James Street; Hodson, Scott & Sons, Ltd.

CARNARVON.—Conversion of Sportsmen's Hall into town hall and municipal offices, for the T.C.; Arthur Hewitt, architect, Llandudno.

CHIPPENHAM.—Rectifier shop, for the Westinghouse Brake Co., Ltd.

CHISLET (KENT).—Additional 100 houses, for the Chislet Colliery, Ltd.

CLECKHEATON.—Works, Moorend, for the Killgerm Co., Ltd., chemical manufacturers, and Messrs. John Sharp, wire manufacturers (£16,000).

COATBRIDGE.—Shops for Clarkston Co-operative Society, Ltd.; Mr. Moffat, manager.

CREDITON (DEVON).—Housing scheme (25), for the U.D.C.; surveyor.

DOUGLAS (I.O.M.).—Stores, Fort Street; Todhunter and Elliot, Ltd. Church, Hilary Street; Christian Science Society.

DUDLEY.—Extensions, mattress factory, Stourbridge Road; F. Flanagan. Additions, Grammar School; governors. Isolation hospital, for the T.C.; borough engineer.

EPSOM.—Housing scheme (38), for the R.D.C.; F. A. Pratley, surveyor, Ashley House.

FURNESS DISTRICT.—Alterations to Leven Valley Co-operative Stores; J. A. Wilson, The Glen, Backbarrow.

GOLDTHORPE (DONCASTER).—Church hall, to seat 500, for the Wesleyan trustees; Sir Alfred Gelder, architect, Hull.

GOSPORT.—School (£18,000) at Brockhurst; secretary, Education Committee.

GUISBOROUGH.—Central schools, for North Riding E.C.; director of education, Northallerton.

HAMILTON.—Coachbuilding and repair works for Messrs. Metcalfe, coachbuilders, of London and Romford; local representative, 26, Bothwell Street, Glasgow.

HAMPTON.—96 houses, Priory Road; U.D.C. surveyor.

HASTINGS.—Additions, Fairlight Sanatorium, Old London Road; Elgood and Hastie, architects. Concert pavilion, Central Cricket Ground; A. Wallis.

HAYWARDS HEATH.—Proposed installation of electric lighting in St. Wilfred's Church; Parochial Council.

HULL.—Central public library extension (£14,000); city architect.

KESWICK.—Town hall, Main Street, for the U.D.C.; surveyor.

KIRKCALDY.—Bakery for Kirkcaldy Co-operative Association, Ltd.; the manager.

LANARKSHIRE.—Picture house at Carluke; M. Burns, manager. Church building at Allanton (£2,200); Rev. J. Cromarty Smith, Coatdyke.

LEITH.—Town hall and library; Bradshaw, Gass & Hope, architects, Silverwell Street, Bolton.

LONDON (EAST HAM, E.).—Additions, East Ham shopping hall, Myrtle Road; East Ham Shopping Hall, Ltd. Alterations, 253-9, Katherine Road; H. Blackman.

(ILFORD, E.).—Distributing depôt, High Street; United Dairies, Ltd.

(ISLINGTON, N.).—Extension, municipal buildings (£48,000); Borough Council architect.

(ST. PANCRAS, N.W.).—Buildings, Pratt Mews, Bayham Street; W. A. Rutter, architect.

LINCOLN.—Church, Addison Drive, for the Wesleyan trustees.

LOWESTOFT.—Electric car house, London Road South; E. J. Ford.

LYMINGTON.—34 houses (£15,099); C. T. Webb, Beaulieu, New Forest, contractor.

MANSELTON.—50 houses, G.W.R. Garden Village Society, Ltd., Swansea.

MERTHYR.—Pavilion, Aberfan; Miners' Welfare Fund.

MUIRKIRK.—Remodelling and extending Furnace Road Higher Grade School, with electrical work, for Ayrshire E.C.; William Reid, master of works, Education Offices, Ayr.

NEWARTHILL (HOLYTOWN, LANARKSHIRE).—Re-erection of 'bus garage, for Messrs. Brown (£5,000).

NEWTOWN.—Smallpox hospital; Worcestershire C.C.

NORTHAMPTON.—46 houses, Weedon Road site; A. Glenn and Sons.

OLDBURY (BIRMINGHAM).—Public baths with public hall (£16,000), for the U.D.C.; surveyor.

OTLEY.—30 houses, Bradford Road; O'Brien & Richmond.

OXFORD.—New kitchens, Oriel College, Magpie Lane; trustees. Students' rooms and extension of kitchen, St. Margaret's Road; St. Hugh's College trustees. Library, St. Aldate's site; Library Committee of Corporation. Two secondary schools; Education Committee. Additions, warehouse, Red Lion Square; Elliston and Cavell, Ltd.

OXFORD.—Two secondary schools, for the City E.C.; Director of Education. Additional housing scheme, for the T.C.; city surveyor.

RICHMOND (YORKS.).—Church, Catterick Camp (£15,000), for the Wesleyan trustees; Arthur Kellett, architect, Barnard Castle.

ROCHFORD (ESSEX). Additional housing schemes (92), for the R.D.C.; surveyor.

SANDWICH.—Additional 30 houses, for the T.C.; borough surveyor.

SCARBOROUGH.—Picture house, Westborough, for the Londesborough Theatre and Picture House (Scarborough), Ltd.

SLOUGH.—Station extensions (£20,000); Great Western Railway Co. Church, Bath Road, for the Wesleyan trustees.

STANDISH (WIGAN).—Cinema and shops, High Street, for E. Bentham. Cinema, Preston Road, for J. R. Horrocks.

STIRLING.—Conversion of infirmary into headquarters' offices and meeting place for Stirlingshire Education Authority; the clerk.

STOCKTON-ON-TEES.—Extensions, Globe elevator works, for Pickering, Ltd.

STROUD (GLOS.).—Nurses' home, General Hospital; A. Linton Iredale, architect, Park Road.

SWANSEA.—100 houses; borough architect.

SWINDON (WILTS.).—Church, Hurst housing estate; Rev. E. R. Knapp, vicar of Redbourne Cheney.

THORNABY-ON-TEES.—School (£10,000), Westbury Street, for St. Patrick's Catholic church; Rev. Canon D'Hooghe.

TROON.—Masonic temple, hall and shops, Portland Street (£4,000); J. R. Johnstone, architect.

TRURO.—Additions, Truro College; trustees. Oil depôt, Newham; Russian Oil Products, Bristol.

WALSALL.—Additional housing scheme (500), for the T.C.; borough surveyor. School, Blakenhall (£9,570), for the borough E.C.; borough surveyor.

WARRINGTON.—Housing scheme (30), Reynolds Street estate, for the T.C.; A. M. Ker, borough engineer. St. Oswald's Church, Padgate Lane (£4,000), for Rev. Father Hind; Wright & Hamlyn, architects; John Dolan, builder. Extensions, Palatine Works, Causeway Avenue; Fletcher, Russell & Co., Ltd. Pavilion, Causeway Avenue; Regals, Ltd. Pavilion, Greenalls Avenue; Greenall, Whitley & Co., Ltd.

WATFORD.—50 houses, Leggatts Rise Estate; Kempster and Williams. Joiners' shop, sawmill, garage and offices, Beachwood Rise; Kempster & Williams.

WEYMOUTH.—Electric light installation, borough sanatorium (£400), for the T.C.; town clerk.

WINCHESTER.—Drainage scheme with pumping stations, for the T.C.; John Taylor & Sons, engineers, Caxton House, Westminster, London, S.W.

WINDSOR.—Bazaar premises, Peascod Street, for F. W. Woolworth & Co., Ltd., Kingsway, London.

YORK.—Extensions, Secondary School, Nunthorpe; Education Committee.